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73 magazine
for radio amateurs

73

ham radio's last year?

See page 24

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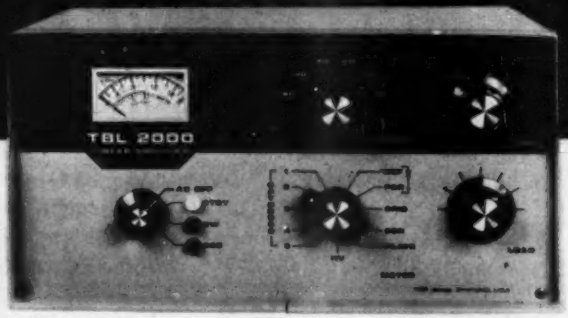

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for radio amateurs
#148 JANUARY 1973

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EDITORIAL BY WAYNE GREEN

REPEATER GROUP ACTIVITIES

One of the great benefits of repeaters is being passed up – more's the pity. Every member of a repeater group has one thing in common – the ability to communicate through the repeater. For some strange reason this unique ability is not being taken advantage of.

There are several valuable functions that can be carried out via the repeater – functions which might help to build the club in members – in prestige – and in service. Obviously the repeater can be used to carry announcements of interest to the group – meeting announcements – repeats of ARRL bulletins – FCC releases – propagation news – and even DX news, if there is some value in this to some ops – news of nearby repeater group meetings and functions – hamfest and convention news for the near and far future – plans for outings such as Field Day, VHF Contests, stuff like that – and plenty etc. If every member of the club was vying to bring news to the repeater, it could be interesting and valuable.

Suppose the news time is set at a convenient time every night, perhaps 8 PM. The club trustee can officiate and solicit news items from members. It could be a lot of fun and help to bring the club together – plus increase interest in club functions.

The next step is to set up weekly technical symposiums – with one member on tap to give a talk and then answer questions from all the listeners. This can be taken from the License Study Guide series in 73 and will help members prepare for their higher licenses.

How about code practice? Why not? A fifteen minute code practice session every night would soon have every club member ready for that General license. You could even go on to Extra, if there is interest. You can use code records, tapes or a member with a key – if there is one. How about starting those code sessions at 7:45 and then give a five minute break at 8 for identifying – then on to the bulletins and stuff?

There is little doubt that you can build up quite a listening audience to such goings on. You will find that not only are all of your members making a big effort to tune in, whether they are at home or in the car, but you'll also start getting listeners with scanner receivers.

GETTING RICH

The more I think of it, the more I'm convinced that one of the really great opportunities open to radio amateurs is in the selling and installation of security devices.

Our radio and electronic background gives us what we need in the way of skills for designing and installing systems.

It is a business that can be started in your spare time and requires no big investment in equipment or offices. You can get started with little more than some letterhead and a phone number.

The market is virtually unlimited – every home, office, business, warehouse, etc., is a prospective customer. You can get started with small home installation and work your way up to large plants and even entire towns.

Your sources of equipment are simple to locate – several distributors have excellent catalogs out. You can sell the system – take a deposit for the job – order the equipment with the deposit – and then make your profit when the job is done and working. And then there are the residuals – the service contract which brings in money from then on.

If you have any question about the validity of the idea, just ask your wife whether she would like to have an alarm system or not. When you are away she will feel a whole lot safer if there is an alarm. You are fortunate if you haven't been burglarized as yet – and the chances are that you have at least one neighbor who has come home to a big surprise – like no more television set – no hi-fi – no cameras – the works.

Once you get started in your spare time the business will take over and you'll soon be working full time – and then some. Then comes employees – salesmen – bookkeeper – and branch offices.

If you do get into this business you would do a lot of fellow amateurs a big favor if you would write to 73 and tell us how you are doing. If you manage to discover some pitfalls you could pass along the word so we could be sure that no one else misses them.

Do write.

AM DEAD YET?

The FCC warning about using AM on the 20-40-80 meter bands was strongly put in Docket 19162 which is effective November 22nd. Paragraph 7 states that "... we strongly urge that ... full power double sideband (AM) emission not be used in the lower four HF bands except in an emergency ..." The message is clear.

Wondering how this edict would be received by some of the AMers on 20m, I tuned up the band the other evening and heard W6QS in contact with a WØ and he was bragging that he was one of a substantial group of AMers, mostly running kilowatts, who were holding forth on the band. When he finished his contact I broke in to ask what effect the new regulations requesting that AM not be used were going to have. I got my answer short and sweet when he called me a liar three times and then switched his rig off.

While I was disappointed to hear this CB-type operation from an old timer with a two letter call, I can't say that I was honestly surprised, for I realize that the emotional reaction to being asked to quit AM is just as strong as was the reaction when the FCC said no more spark in the 20's.

How much nicer for all of us are the chaps who embrace new ideas and new modes – the fellows who get into slow scan – satellite relaying – like that. We will always have a few curmudgeons who will fight progress to the last ditch, rationalizing as they go down. The FCC is, for once, stating the majority opinion when they say that we really can't afford the luxury of AM on the lower bands.

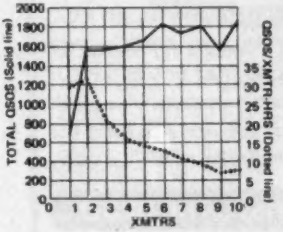
FIELD DAY PLANNING

The Foothill Amateur Radio Society (Mt. View, Cal.) brought up a very interesting point for Field Day committees to ponder when they are making their plans for 1973.

Ted Harris W8RPA/6 did some research on the average number of contacts scored by the five top clubs in each transmitter group over the last five years and put the info on a chart. The result is fascinating and seems to defy logic. At the very least there seems to be a lot to learn from it.

Plotted on the chart you can see that the number of contacts made per transmitter drops off after two trans-

mitters. Three transmitters did not result in any more contacts than two! And four didn't help matters very much either. Nor did the fifth. The sixth transmitter seemed to make more of a difference – perhaps that one should have been used in third place. The seventh transmitter must have broken down so often that number six had to take time off to help fix it. And how about the nine transmitter clubs doing worse than the two transmitter efforts! How is it possible to make fewer contacts with nine rigs than two? Perhaps they were all on the same band.



It would appear that a whole lot of planning is needed to change this weird pattern. There must be some way to make more contacts with three stations than two!

Continued on page 142.....

SSTV SCENE

Dave Ingram K4TWJ
Rte. 11, Box 499, Eastwood Vil. 50N
Birmingham AL 35210

Last year during the worldwide Slow Scan contest there was an apparent trend toward white lettering on a black background. If I were to make an educated guess on this year's trend, I would probably say 4 second i.d. frames will be quite popular.

A 4 second frame displays your call, for example, on the top half of the screen, then as the trace nears the middle of the screen, a 1200 Hz vertical "blip" comes along and resets it to the top, and the procedure is repeated. Since your call is now being presented twice as often on the top half of the screen, while the bottom half is not being swept, the result is a brighter image, and if QRM "zaps" part of your call on the first sweep, chances are the second sweep will fill in the gaps, thus still making your call perceptible. How do you obtain 4 second frames from your gear? Well, the vertical rate control may adjust down to a 4 second rate, or IC "counters" can be tapped at this point. If you don't care to go into your commercial gear, just make up some 4 second tape loops (I described tape loops in the September '72 column).

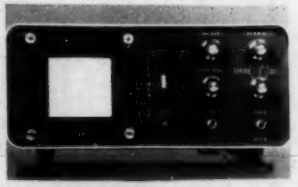
First SSTV QSO via Oscar 6. Not bad!

Don Miller W9NTP and Phil Howlett WA9UHV have laid claim to the first SSTV QSO via an amateur radio satellite. During orbits 30 and 41 they successfully exchanged reasonably fair pictures through the then 4-day-old Oscar 6. Although they had managed to exchange approximately 40 partial frames during earlier orbits, it was not until October 19 that pictures approached "solid copy" state. This month's "Oscar 6" picture (compliments of W9NTP) was one of the first few received by Don from WA9UHV. Not bad, eh? Probably you noticed the two or three Slow Scan signals through the satellite during each pass varying tremendously in level. This was due to the CW signals "loading down" the little "one watt repeater." Here in Alabama, the only distinguishable pictures (during that first week of Oscar 6) were from WA9UHV, as he and W9NTP tried for a perfect exchange. Now, since the satellite has been up a while, activity has probably settled down to where Slow Scan is easier through the satellite . . . look in some night between 29.450 kHz and 29.550 kHz (W1AW nightly bulletins give times of equatorial crossings). I think you will agree, Slow Scanners have the persistence of a P7 tube, and the enthusiasm of a firecracker.

The idependent sideband system (transmitting audio on either upper or lower sideband, and video on the other (simultaneously) is growing in interest, and may become quite popular during '73. W7FEN, the "Father of the ISB idea," and WØLMD/4, have developed ISB units for use with commercial gear, like the Heath Transceivers. I understand WØLMD's unit uses a pair of surplus Collins filters, and has exceptional SB to SB and carrier suppression. If you're seriously interested in this system you might contact either Gervie W7FEN or Robert WØLMD for circuits and specs.

If you haven't already heard, another company, Thomas Electronics, Box 572, Hendersonville TN 37075, has recently entered the Slow Scan field. The info on their gear looks great. Their monitor displays a 4.5 in. picture, has an attractive aluminum CRT bezel, sync tuning meter, and vertical retrigger button mounted on the front panel. I think their camera is a real winner. Slow and Fast Scan outputs are provided on rear panel jacks. In fact, you have a choice of video or rf Fast Scan output; thus you can use your regular TV set as a Fast Scan monitor (even while televising Slow Scan!). Further, the Fast Scan output is adjustable from Channel 2 through 6, so you can pick a blank channel for your area. Another big advantage of this camera is the built in ac power supply; thus the camera is completely self contained (you SSTVers with only a monitor and tape recorder take note here). I suspect we will hear quite a bit more out of this company during 1973.

THE MXV-100 MONITOR



One of the newer companies to enter the SSTV field is J & R Electronics of Poughkeepsie, New York, who is manufacturing the MXV-100, a superb slow scan monitor.

The monitor is built in a Heathkit styled cabinet the same size and color of the SB-200. The front panel is dark green plexiglass with lettering behind the plexiglass, resulting in quite an attractive unit that matches Heath equipment perfectly.

Inside, viewed from the front, the cathode ray tube is mounted on the left and the two plug-in printed circuit cards are mounted on the right. The smaller card is the high voltage power supply and the larger card contains the major monitor circuitry. A third printed circuit board is mounted vertically in approximately the cabinet's middle. This contains the interconnections for the other two boards, and some of the low voltage power supply components. The remaining low voltage power supply components are mounted under the chassis. A 6FG6 tuning eye tube is mounted on the front panel for aid in tuning signals

73 RIG OF THE MONTH SPONSOR

Amateur FM Comes of Age

Henry Radio proudly announces the new Tempo line of amateur FM transceivers for the 146 and 220 MHz bands. The Commercial Line transceivers are so fine they can meet the tough FCC requirements for Type Acceptance in commercial two-way service. A broad line of transceivers so modestly priced that any amateur can own one. Transceivers that defy comparison for both performance and value. Transceivers that are not a dream for tomorrow but are available right now . . . today.

TEMPO'S "COMMERCIAL LINE" TRANSCEIVERS . . . THE BEST!

TEMPO/CL 220

As new as tomorrow! The Tempo Commercial Line VHF transceivers offer commercial performance at amateur prices. Both units include an audio limiter to assure constant deviation at all times and an instantaneous impulse squelch. Microphone, power cord, mounting bracket and one pair of crystals is included.

GENERAL SPECIFICATIONS:

- Frequency Range: 220-225 MHz (2 MHz operating range)
- Number of Channels: 12 channel capability for transmit and receive
- Microphone: Dynamic with coil cord
- Dimension: 2.36" H x 5.90" W x 7.66" D
- Weight: 4.5 pounds
- Frequency Stability: ±0.001% (−20° to +60°)
- RF Power Output: 10 Watts or 3 Watts.
- Output Impedance: 50 ohms unbalanced.
- Sensitivity: 0.5 microvolts nominal for 20 db quieting.
- Spurious & Image Attenuation: 70 db below desired signal threshold sensitivity.
- Adjacent Channel Selectivity (15 KHz channels): 70 db attenuation of adjacent channels.
- Type of Receiver: Dual conversion superheterodyne.
- Audio Output: 2 Watts minimum w/internal speaker (at less than 10% distortion)
- The price: $329.00

TEMPO/CL 146

- Frequency Range: 146-148 MHz
- Same general specifications as CL 220
- The price: $279.00

THE TEMPO "VALUE LINE" . . . THERE'S NO BETTER BUY!

TEMPO/fmp

Truly mobile, the Tempo/fmp 3 watt portable gives amateurs 3 watts, or a battery saving ½ watt, FM talk power anyplace at anytime. With a leather carrying case included, this little transceiver will operate in the field, in a car, or at home with an accessory AC power supply. The battery pack is included. Frequency Range: 146-148 MHz
The price: $225.00

(Accessory rechargeable battery available: $22.00)

TEMPO/fmh

So much for so little! 2 watt VHF/FM hand held. 6 Channel capability, solid state, 12 VDC, 144-148 MHz (any two MHz), includes 1 pair of crystals, built-in charging terminals for ni-cad cells, S-meter, battery level meter, telescoping whip antenna, internal speaker & microphone.
$189.00

TEMPO/fmv 2

So much for so little! This little 10 Watt VHF FM transceiver offers high quality performance and features usually found only on more expensive units. Features such as AFC on receive and separate switchable Transmit/Receive sections. Includes mounting bracket, heavy duty power cord and provisions for accessory AC power supply. Frequency: 146-148 MHz, 11 channels, 25 KHz channel spacing, 13.8 VDC ±10% operation (standby −100 ma, receive −150 ma, transmit −3.0 amp.)
The price: $199.00

TEMPO/TPL high power fm amplifiers

Miniature power houses! Operates directly from a 12 VDC power source, automatic antenna switching, incorporates Balanced Emitter transistors and state of the art design practices, making it virtually immune to damage due to high VSWR or misloading conditions.

MODEL NUMBER	POWER INPUT	POWER OUTPUT (min)	BAND	PRICE
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TPL1002-3B	1-3W	80W	2M	$235.00
TPL802	5W	80W	2M	$180.00
TPL802B	1 to 3W	80W	2M	$195.00
TPL502	5 to 15W	35-55W	2M	$105.00
TPL502B	1 to 3W	45W	2M	$130.00
TPL252-A2	1W	25W	2M	$ 85.00
TPL445-10	1 to 2.5W	12W	440MHz	$125 00
TPL445-30	4W	30W	440MHz	$215.00
TPL445-30B	1W	30W	440MHz	$235.00

TCP 12A Control Head . . . $32.00

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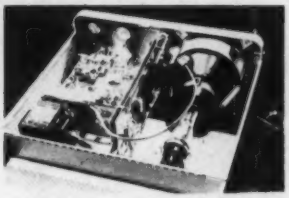


Inside view of the MXV-100 monitor.

properly. Except for the 6FG6 and cathode ray tube, the monitor is all solid state.

During actual operation, an incoming slow scan signal is fed to the main monitor circuit board, and is then limited and amplified. The 1500 to 2300 Hz tones are then passed through the low pass filter to the video amplifier. Output of the video amplifier (approximately 100V) is sufficient to totally cut the beam off on absolute blacks, even when the brightness is extremely high. The sync pulses are taken directly from the limiter, and processed through two filters, the noise immunity circuits, and the pulse shapers, before reaching the sweep circuits. The result is a monitor that really "digs in" to get those slow scan pictures. We particularly liked the sync circuitry of the MXV-100. Briefly, it works like this: A 30ms 1200 Hz pulse is received and a picture starts. The input gate then closes and doesn't open again until time for the next pulse; approximately 7½ seconds for the vertical, and 50ms (length of each line) for the horizontal. If a pulse is received, the trace is reset and the process is repeated. If no pulse is received, the dot stays deflected off the screen. This type of gated input makes false triggering of either the vertical or horizontal practically impossible. A manual vertical retrace button is mounted on the front panel in case a retrace pulse is lost.

The noise immunity circuits in the MXV-100 compare the input pulses against a predetermined level. If they are of the proper amplitude, they are accepted as sync pulses. If they are too low, they are rejected as noise. The circuit will follow a signal right down to the "trash" level before rejecting it. Remember, the active filters have already ascertained the pulses are 1200 Hz pulses.

The unit we received for evaluation did a beautiful job. During some tests, using taped pictures with known content, other local slow scanners and myself noticed small details we previously had not noticed significantly with our own monitors. The pictures appeared exceptionally clear and quite bright. I think this is mainly due to the aluminized 5AHP7, an electromagnetically deflected and electrostatically focused cathode ray tube, with 5500V on the accelerator. Also, there is no yellow filter on the face. Although one can easily be added, we personally prefer the unfiltered screen. I found a viewing hood unnecessary. In fact, I didn't even cover the window during afternoon operation, when the sun reflects into the shack (this usually requires a hood with my 5UP7 homebrew monitor).

The low pass and noise immunity circuits did a superb job pulling signals right out of the mud. Often I could read a station's call sign off the screen before I could hear them give their call. If QRM came on close to 1200 Hz (and it had to be close – the filter is pretty sharp) for, say, one second, the monitor would merely leave a blank space of 15 lines (120 lines divided by 8 seconds = 15 lines per second), then immediately lock back and resume the picture. In fact, the ability of the monitor to "latch onto" a signal instantly was quite attractive.

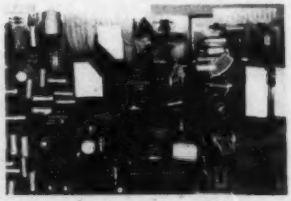
Although the 5 inch screen may seem slightly small to some of you (there is a trend toward the 7-inch screens), this was fine for me. Possibly this is because I located the MXV-100 right above my present 5 inch monitor, which was placed for perfect eye to screen distance previously.

The sync tuning eye is a unique feature of the MXV-100. Since the sync frequency filters are sharply tuned, when a signal is off frequency, the screen is dark, instead of streaked to one side or the other and the eye tube (like on some stereo tuners) is "open." As the signal is tuned on frequency, the eye closes (again, like a stereo). This foolproof tuning has to be seen to be appreciated.

The unit uses top quality parts throughout, and boards are G10 class. All inline integrated circuits are plugged into sockets for easy servicing.

I noticed the deflection yoke was a Stancor item, with a long part number, evidently specially made for J & R.

All connections to and from the monitor are on the rear of the unit, and connection to your rig is described fully in the operating manual.



Close-up of the neatly engineered circuit boards.

All in all, we found the MXV-100 a real gem of a monitor.

I understand J & R is working on a slow scan camera system, which may be offered soon in an attractively priced monitor/camera package.

Once again, the manufacturer is *J & R Electronics, Box 1646, Poughkeepsie NY 12601.*

...K4TWJ

ENGLISH RADIO MUSEUM

Are you interested in seeing what wireless was really like in the twenties, and hearing those crystal-sets and horn speakers swarking away . . . well, just pop over to England where they've opened a Wireless Museum, the only one in the world where the visitors are permitted to handle the exhibits! There are dozens of sets on view, many of them dating from the early days of broadcasting in England – 2LO opened up in November 1922. There is even one which was used in the trenches during World War I. The Museum is run by the recently formed Wireless Preservation Society, devoted exclusively to the collection and renovation of wireless and electronic equipment for purely cultural, educational and historical purposes. It is an entirely non-profit making organization, and all its officers are honarary. The hon/secretary and Musuem Curator is Douglas Byrne, G3KPO, of Homa House, Quadring Watergate, Spalding, Lincolnshire, and it would be advisable to contact him by ringing STD 077-584-485 prior to a visit to the museum.

RRTY GEAR

The Santa Fe Railroad has recently been replacing its in-service Model 14 & 15 Teletype gear with more up-to-date units. It seems they had no idea that someone might still be interested in such "out of date" equipment, so they sold most of what they had in ton-lots as SCRAP METAL! Bill Johnston WB5CBC heard about this sacrilegious action and managed to have a hold put on the 120 or so units left. The gear is being sold as-is, but most were pulled right out of service and are in perfect shape. The units are along the Santa Fe's main line be-

escape from the 2 meter crowd

The all new
220 MHz Clegg FM-21 Transceiver puts you in tomorrow's channels today!

220 MHz FM is *the* early solution to overcrowded 2 meter channels. Here's your chance to get in on the ground floor of the FM future. The new FM-21 all solid-state transceiver is an opportunity to "do it right" this time and start with the leader. The FM-21 uses only 1 crystal in any channel . . . one crystal gives you a separate transmit and receive frequency as well as automatic 1.6 MHz programming in the repeat mode. We call this unique triple-duty crystal feature Clegg Crystal Saver Frequency Control. For the complete story, see your Clegg Dealer or call or write us today for detailed data sheet and avoid the crowd.

CHECK THESE FEATURES

- 8-10 watts output (minimum).
- Speech clipping.
- Sensitive receiver—.25 μv (max.) for 12 db Sinad.
- Selectivity—Adjacent channel (40 KHz) down 50 db.
- Each crystal does triple-duty, providing a transmit and receive frequency (Crystal Saver Frequency Control).
- Monolithic crystal filter.
- Compact, rugged, attractive.

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tween Topeka, Kansas and Los Angeles CA, and must be picked up at their location. Prices range from $10 for a Model 14 Non-Typing Reperferator to $25 for a Model 15 Page Printer. Contact Mr. C. C. Glover, Purchasing and Materials Dept., AT&SF RRY, P.O. Box 1674, Topeka KS 66601.

AMSAT NEWS

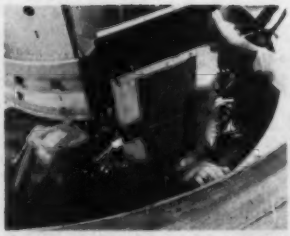
Mike Frye WB8LBP
640 Dauville Dr.
Dayton OH 45429

THE OSCAR 6 AMATEUR SATELLITE IS IN ORBIT!

NASA team inspector swabbing down AOC (courtesy NASA-USAF).

OSCAR 6 was launched from NASA Western Test Range on Sunday, October 15, 1972, piggyback with the NOAA-2 weather satellite. Its big Thor-Delta rocket put it into orbit over the South Pole. It flew across the Equator east of Africa, and the spacecraft was ejected over the Mediterranean. OSCAR came to life immediately, and European and African amateurs reported hearing signals through the satellite repeater.

OSCAR is in a circular polar orbit 910 miles high. Thus it is line-of-sight to stations nearly 2,500 miles away. Amateurs 5,000 miles apart should be able to communicate through it. OSCAR circles the earth every 115.0 minutes at an inclination of 101.77 degrees. In that time the earth has turned to the east under it 28.75 degrees in longitude. Therefore, if you have one official prediction, then by simple addition you can figure out all future equator crossing times and the corresponding longitudes. Copy the broadcasts from W1AW any night get



Satellite as it is being placed inside ITOS-D rocket (courtesy NASA-USAF).

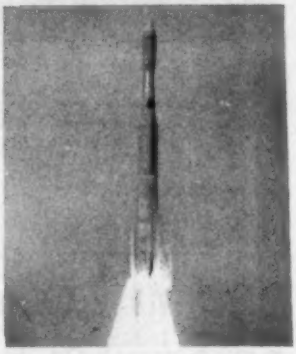
orbital predictions for the next day. The speed of the satellite is in excess of 15,000 mph. Hence the Doppler shift will make the signals slowly drop in frequency on your receiver as much as ±4½ kHz each passage. The power output on ten meters is about a watt maximum to a dipole.

OSCAR's repeater is entered on two meters – 145.90 to 146.00 MHz. Signals are relayed out on ten meters – 29.45 to 29.55 MHz. You should hear signals throughout this 100 kHz passband, and up to 50 kHz below and above it. All modes can be used through it, but CW and SSB are the most efficient. Technicans are authorized to operate through the satellite by FCC waiver. The satellite is sun-synchronous, i.e., it will appear overhead at approximately the same times each day, around 9 AM and 11 AM each morning, and 9 PM and 11 PM each night, regardless of your location. The morning passes come down from over the North Pole, and the night passes come up from across the Equator. A flyover lasts only about 20 minutes, so you must know the times pretty closely. If you have a ten meter beam, lucky for you. Most of us are using just dipoles or long wires. Just 10 watts of two meter

Satellite and launch vehicle on the pad just before countdown started (courtesy NASA-USAF).

power is adequate to work through the satellite, particularly on an overhead pass.

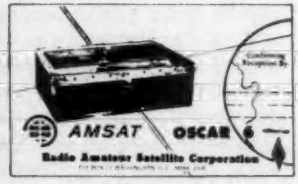
K2RTH of New York was able to hear his own signals through the satellite when it was over Dakar in W. Africa, over 3,000 miles away. Amateurs in over two dozen countries are being heard and worked through OSCAR. OSCAR also carries a beacon on 435.10 MHz. It has 300 mw output and sends 24 three-digit numbers representing telemetry in Morse code at 10 or 20 wpm. This tells us the operating conditions within the satellite.



OSCAR 6 launch, Oct. 15, 1972 at 1719 GMT (courtesy NASA-USAF).

OSCAR 6 has solar cells and a nickel-cadmium battery and was built for a year or more of useful life. So there is plenty of time for you to get equipped on 145 and 435 MHz.

Keep a log of stations heard and worked, with date and time. Submit your log periodically to AMSAT and you will receive a colorful QSL in return.



OSCAR 6 QSL card. To receive one, please send report to AMSAT, Telemetry Dept., P.O. Box 27, Washington, D.C. 20044.

For more information or problems you may be having, please send SASE to me and I will do my best to help you.

I would like to thank Palmer E. A. Back WB6QLY for helping me get the photographs.

WB8LBP

TOTAL

Get total 146-148 MHz coverage without buying a crystal!

The modified Clegg FM 27B transceiver now covers the entire range of 146-148 MHz . . . and needs NO additional crystals. It's the only 2 meter rig *available now* with built-in total coverage that also offers greater than 25 watts output power, uses 10 IC devices, and has Teflon* wiring throughout. Not a single bi-polar device is in the RF path in transmitter or receiver . . . ensuring greater reliability. Accessory power supply and sub-audible tone on transmit are available too. At home or in your car, the FM 27B gives you the ultimate in total 2 meter performance. See your Clegg Dealer NOW or write or phone us today for detailed data sheet on our 2 meter leader.

CHECK THESE SPECIFICATIONS

GENERAL

POWER REQUIREMENTS: 12 to 14 VDC
Current Consumption at 13.5 VDC:
Receive: 4 amps squelched, 1.2 amps unsquelched.
Transmit: 6 amps max.

DIMENSIONS: 7⅛" x 3½" x 9¼" deep; 4 lbs. net weight.

RECEIVER

TUNING RANGE: 146.00 to 148.00 MHz, continuously tuneable with reset capability of approx. 1 KHz to any frequency in range.

SENSITIVITY: .35 μv max. for 20 db quieting; .1 μv for reliable squelch action.

SELECTIVITY: 11 KHz at 3 db; Less than 30 KHz at 70 db. Adjacent (30 KHz spaced) channel rejection more than 70 db.

AUDIO OUTPUT: 2.0 watts (min.) at less than 10% THD into internal or external ohm speaker.

TRANSMITTER

TUNING RANGE AND CONTROLS: Same as RECEIVER.

POWER OUTPUT: 25 watts Min. into 50 ohm load. P/A transistor protected for infinite VSWR.

MODULATION: Internally adjustable up to 10 KHz deviation and up to 12 db peak clipping.

*DuPont trademark

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AR	WB6KFK	Forest City	16–76
CA	WA6TDD	L.A.	FM 147.435–146.40
			AM 147.405–145.40
CT	W1WHZ	Norwalk	147.99–39
MA	W1DC	Billerica	147.72–12
PA	WA3KFX	Hollis	01–61
PA	WA3KXI	Lancaster	34–94
PA	WA3CAG	Trevose	19–79
RI	K1OHE	Dolete	

RTTY REPEATER

A new FM repeater serving the Bay Area RTTY stations has just been announced, according to Tom Nelson W6QGN. Using 2125 mark/2975 space tones at 60 wpm, it has an input of 147.93 MHz and an output of 147.33 MHz.

The new repeater is a joint effort of WA6EUZ and WB6IMP and will temporarily operate under the latter's call. It will be an open repeater and all amateurs are invited to participate. Although presently installed as a COR (carrier) access direct audio device, future modifications will provide signal regeneration, automatic date/time entries, and other special features.

50 MHz BAND

Bill Turner WAØABI
Five Chestnut Court
St. Peters MO 63376

A previous column made mention of WTWO-TV with reference to this station being located in Indianapolis. W9JCU, who happens to be the Chief Engineer, sets me straight on the actual location, which is Terre Haute, Indiana. This is what happens when you don't make a log entry and rely on your memory for the details. Arden goes on to say that the GE Bat-Wing antenna on a 1000' tower, was loaded up on 6 during Field Day, and between the hours of 1:3 0 and 6:00 in the morning, 22 States were worked. How would you like to have an antenna like that on a permanent basis?

WA1EXN reports conditions had been very poor until the opening of October 17th. Art says, "This is the first time in 7 years of VHF operations that signals ever pinned the S meter at slightly over 60/9. Ask WØHZ." Art worked WØ's, W4's, and W9's during this one. A brief opening from Maine to Florida was noted on October 30th from 1436 to 1638Z. October 31st and November 1st brought very good aurora. I also worked these openings with very good results. Among those most active were K9HMB, K8BBN, WA8MLV (running a Yaesu transverter), WA1OUV, VE3FHK and WB3JCK. The most unusual contact reported was from the Chicago area to Casper, Wyoming.

VE1ASJ is off the air on 6 at the moment due to a storm blowing a tree against his tower. A new tower is in the works and may well be in operation by the time this appears in print.

WØTVD, Omaha, would be happy to sked anyone needing Nebraska. He runs a Swan 250C and a 6 element wide-space Telrex at 55 feet. Chuck says in his letter that WØCCD, known as "Grandma Lou", will be back on the air with a Swan and a 6 element Hygain thanks to her many friends around the country. I can personally verify that she made the grade. Just a few evenings ago I heard her talking to John WAØHTP. Chuck mentions the October 17th opening as having lasted around 5 hours, working its way down the east coast, across the Gulf states and finally ending up in the Texas/New Mexico area.

Bob WB8JHT, will soon has a new KW PEP linear on the air – in fact, it should be in operation by now. Bob will be running a pair of 4x150A/7034's in a passive grid configuration similar to the one in the July 1969 issue of 73.

Anyone interested in running a beacon will find any number of endless loop tape recorders on the surplus market currently. These are usually described as "message centers" or something similar. Prices run from $4 to $12 depending on how deluxe a model you buy. The cheapest I have seen is from Burstein-Applebee, Kansas City, as $3.95. A few simple modifications are needed to make it acceptable for this purpose. I will be happy to send a list of hints to anyone interested.

WAØABI

Keith Lamonica W7DXX/1, Managing Editor of 73, listening to the first "beeps" of Sputnik I a few years back (too many).

WITH THE FCC

OUCH!
See the proposal on page 24!

RM-1604
Before the
Federal Communications Commission
In the Matter of

Amendment of Part 97 of the Amateur Radio Service Rules to revise the station identification requirements for transmissions of less than two minutes. Order adopted October 20, 1972. Released October 20, 1972.
By the Chief, Safety and Special Radio Services Bureau.

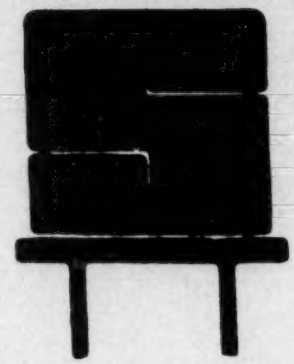
1. The Commission has under consideration a petition filed by Michael R. Beverly proposing amendment of Part 97 to change the station identification requirements for amateur radio communications of two minutes or less.

2. The petitioner proposes to add a new subsection to §97.87 which would require the control operator of an amateur station to identify his station and the station being called at the beginning of a transmission and, if the transmission was less than two minutes in length, the concluding identification would consist of only the calling station's call sign. The Commission's Rules on station identification require the control operator to identify both his station and the station he is calling at the beginning and conclusion of every transmission.

3. The petitioner asserts that this proposed change will facilitate punctuality and efficiency for short exchanges. Petitioner further asserts that compliance with our present identification rules is difficult with a very short transmission.

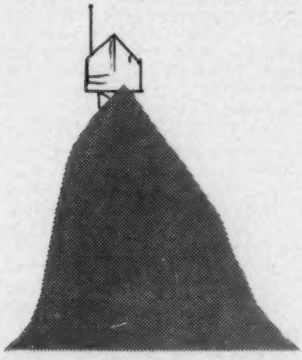
4. The present station identification rule provides rapid identification of a station to prevent one way communications broadcasting, identification of stations conducting international third party communications, and identification of stations conducting radio communications with stations in countries which ban communications with U.S. amateur stations. While the required form of identification may be somewhat awkward during very short transmission, the reasons for this identification procedure remains the same regardless of the length of the communication.

5. The Commission, therefore, believes that there is no justification for this proposed rule amendment. In



REPEATER OWNERS

Don't Take Chances. SENTRY offers custom made crystals made exactly to your specifications. When it comes to crystals for your repeater, BUY THE BEST – SENTRY.



REPEATER USERS

If you want reliable access to the repeaters in your area, you want and need SENTRY CRYSTALS. SENTRY CRYSTALS are custom made for your rig. We don't stock a large quantity of crystals for a certain frequency and hope you can tweak them to frequency in your rig. We do offer FAST service on crystals made especially for you and your rig. If you want reliable, on-frequency operation, INSIST ON SENTRY.

SENTRY MANUFACTURING COMPANY
Crystal Park, Chickasha, Oklahoma 73018

PHONE: (405) 224-6780
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view of the foregoing, the rule making petition plainly does not warrant Commission *en banc* consideration, Accordingly, the Comission by the Chief, Satety and Special Radio Services Bureau, pursuant to the authority delegated in §0.332(m) of the Commission's Rules, ORDERS, that the petition filed by Michael R. Beverly is DENIED.

Federal Communications Commission
James E. Barr
Chief, Safety and Special
Radio Services Bureau

990 kHz SPACING

The proponents of discarding the adopted 600 kHz band plans (CARC, SERA, NERA, Texas, Central States, etc.) have listed a number of potential advantages of going to a wider input/output spacing on two meters. It is instructive to examine the technical facts of the matter.

The most frequently stated advantage of the wider split is a reduction in repeater receiver desensitization. Let us examine the actual numbers. Most FM receivers and transmitters have a selectivity characteristic which is dominated by two poles for strong off-channel signals greater than 200 kHz (at two meters) removed from the desired frequency. The slope of such a selectivity characteristic is 12 dB per octave. Therefore the reduction in desensitization achieved by going from 600 kHz to 990 kHz separation is given by

$$40 \log_{10} (990/600) = 8.7 \text{ dB}.$$

Since a typical duplexer has 90 dB of isolation, this improvement of less than 10% is hardly worth the effort and expense of a major recrystalling job. In addition, the power limitations imposed in Docket 18803 will make the wider split less attractive to those high power repeaters who used the additional few dB of isolation to compensate for marginal duplexer performance. (W1GAN has shown that his duplexer design has isolation which is adequate for at least 60 watts of RF, which is 240 watts ERP when a 6 dB gain antenna is used. In fact, his duplexer is being successfully used with up to 200 watts of RF.) Even if the full 8.7 dB could be realized as improved receiver sensitivity, the increase in repeater range would be something less than a factor or two. Since a typical duplexer cavity has 30 to 35 dB of isolation, we will not be able to use fewer cavities in a duplexer for 990 kHz spacing.

It has been proposed that to ease the repeater user's burden, each existing repeater should establish a second 990 kHz repeater using the old output frequency for the input of the second repeater. Thus no one would be stuck with useless crystals. The fallacy here is that the new repeater's output and the old repeater's input are still separated by 600 kHz, and similarly for the old output and new input. Therefore, there is actually no gain in transmitter/receiver isolation if these two repeaters share one site.

It has been claimed that the shift to 990 kHz spacing will give us more repeater channels. Of course, this advantage is negated by the proposal that every repeater group use two frequency pairs. At first sight, it would seem that 990 kHz spacing would yield 33 repeater channel pairs compared with 27 (an increase of 22%). However, a guard band is required between the repeater input and output bands to reduce intermodulation interference to repeater inputs. There also is a demand for simplex channels on which no repeater operates. Thus the apparent gain in total number of repeater channels will not be realized in practice.

The most common argument against the existing 600 kHz band plan (half of the channels in-low/out-high and half in-high/out-low) is that transmitters cannot operate efficiently over a 2 MHz spread in frequency. However, such arguments have no basis in fact. We have experimentally verified that the power output of the Motorola "80D" transmitter is down only 1 dB ±1 MHz from the frequency for which it is tuned up. This small reduction in output power will cause no perceptible reduction in communication range. Therefore, if a transmitter is peaked at 146.94 MHz, it should conveniently cover the entire FM repeater segment of 146–148 MHz.

In general, receivers will not cover such a large frequency spread without a greater loss in performance, due to having a larger number of high-Q tuned circuits in their input stages, so that it makes good sense to keep all the output frequencies clustered together.

It has been claimed that it is impossible to use a "sensitive solid state receiver" in a one-site repeater with 600 kHz spacing. The experience of some of our more progressive repeater groups directly contradicts this. In fact, a properly designed solid-state receiver will be less susceptible to interference than will a more conventional receiver using vacuum tubes. Modern solid state devices offer performance that could only be dreamed of a few years ago.

Some amateurs feel that frequency synthesizer design will be more complex with the current 600 kHz band plan. However, those of us who have actually designed and built synthesizers know that no one offset is any harder than any other, provided it is an integer multiple of the channel spacing. From the user's point of view, it is easier to use an offset that is a multiple of 100 kHz, since the mental arithmetic is easier.

Finally, we should go back a few short years in FM history and recall that our FM pioneers were satisfied in many cases with a 420 kHz split. Perhaps 90% of the repeaters in the U.S. are on the 600 kHz standard today. Let's keep it that way.

L. D. Collins K4GGI
S. J. Murray K1KEL
P. Catala F2BO/W1

Joe Kasser G3ZCZ/W3
1701 East West Highway, Apt. 205
Silver Spring MD 20910.

Establishing communications with the locals when on a trip can be as difficult as you make it. If you can work into the area on the hf bands beforehand, you'll usually get a name and telephone number to call when you arrive. If you have a Technician call or do not have any hf equipment, then get a friend to call someone on the band for you.

When you go take an up-to-date callbook with you, too. Take some gifts with you, too. If you are going overseas don't forget to take advantage of the duty-free liquor and cigarettes available. They make very useful presents. U.S. postage stamps and magazines or knickknacks are appreciated by those who collect the things. To another ham who homebrews, some of the more exotic (and expensive overseas) IC's or VHF power transistors will be appreciated almost as much as gold ingots. If you did establish contact prior to your trip, you could always have asked what to bring. Twenty-one cent mint postage stamps will be appreciated by the DX'er who has to purchase IRC's to get QSL cards from stateside managers.

If your take a rig with you and get a permit, call in on a local frequency or repeater. Your foreign call or reciprocal one and unusual accent will be recognized, and you will have a small pileup on your hands if you are on VHF. If you ask for information

about clubs, stores and activities one or two telephone numbers are bound to be mentioned.

If you don't take a rig, use the callbook blind, by looking up calls in the local area, then looking up the name and address in the phone book. This is not an instant success method because the chap may not speak English, or may not be at home or active, or may just be unfriendly.

If you are able to monitor the local bands, then you can look up those calls that you hear in the call book and cross reference to the phone book. If you don't speak the local language fluently, then try to get someone else who can, to make the call – or if that is not possible, then practice the important sentences over and over again before making the call – ones like: "May I speak to . . . . . ", or, "I am . . . . . from . . . . . .What ham activity is there in the area?

Explain who you are, say that you are monitoring him but don't ever ask for an invitation to his home. Ask instead about local stores, clubs and activities in general. There is a 99% probability that he will invite you to his home, so why push yourself on him. Let him be the good guy.

I'd like to use this column to pass on trips from travellers to intending ones, so please let me hear from you.

For those going to London, England, the two meter repeater reported to be there is actually in Cambridge. More about that next time.

G3ZCZ

INDXA NEWS

INDXA NEWS LETTER

From THE DXERS MAGAZINE

During the past 2½ years Indxa has been associated with a few DXpeditions. I define a DXpedition as one or more hams going to a specific place at a specific time for the sole purpose of making as many QSOs as possible in a time span of 2 days to maybe two weeks. Below are shown the result of a few of the operations.

Place	Duration	No. Ops	No. QSOs	Remarks
Palmyra	1 week	1	1600	Transceive-murder
E. Pakistan	4 days	1	800	Transceive-dipole
Dominica	4 days	1	3600	Split-beam, ssb/cw
Norfolk	2 weeks	1	10,000	Split-beam ssb/cw
Willis Is.	6 days	5	10,500	Multi-split-beam
Bajo Nuevo	3 days	4	4200	Split-hurricane
San Felix	3½ days	2	7000	Split-beam

From the above data you can see that the results are about what you would expect, but the weight to be attached to each factor is not so evident, i.e., is it better to have more operators, or one operator with a beam (considered to be synonymous with a stronger signal). In my experience with planning and working DXpeditions (I have never been on one) the following factors emerge:

1. By far the most important factor is to have a good signal into whatever area of the world is being worked. This outweighs all other factors for the simple reason that if the callers can't hear the DX they don't know when to call and when to shut up. If you have ever heard OD5BZ working transceive and making 200 QSOs per hour you know what I mean. He was 40 over everywhere. DXpeditions should use beams no matter what else ain't.
2. The skill of the operator(s) is next. Courteous but firm, produces the best results. Outright nastiness produces more of the same and trying to accommodate everyone at the same time produces chaos.
3. Split frequency falls third in importance in my opinion. It helps a great deal of course, especially in the first hours of operation when the DXpeditioners are trying to get rid of the first two thousand big signal Ws and about 500 DX headhunters. After that its importance goes way down.
4. There is a strong tendency to forget most of the big guns have mixed totals, i.e., both phone and CW. A good CW operator can still run rings around a phone operator. In other words, the number of satisfied customers goes way up when a good CW operator is on the DXpedition.
5. After the above items, lots of things enter into the total QSOs. The time spent operating is obviously germane. About 12 kilo QSOs will wipe out any place. That means 2 operators operating 4 hours on and 4 off for 6 days, alternating phone and CW.
6. The bands operated should be considered. Twenty is still the work horse, followed closely by fifteen. Ten meters is great for a few hours a day. The low bands should be used only to accommodate the 200 or so guys working for 5BDXCC. Really there are surprisingly few of them. I have never seen any DXpedition for which I QSL work more than 120 stations on 80 and 40 and most of those did not request a QSL. The number of topbanders you can count on both hands and no toes.

In summary, one or two guys going to a rare one, operating transceive with a vertical, produces frayed nerves, frustrations, and a barrel of fun. Us big gun, big signal, persevering, skillful operators get through anyhow. Heh, heh, heh. You peasants wait for the multi-op, split to linear to beam operation and you might make it.

Not that it has anything to do with conducting DXpeditions, but you might be interested in knowing about QSLs resulting therefrom. 8000 QSO's will produce about 1500 requested the first week, another 1500 in the next two months, another 1500 in the next six months and a total of about 5000 in 18 months. The rarity of the operation does not seem to make much difference in the total requests. The green stamps will total about $350 and nearly all of it will be in the first 1500 cards. So you see I got it all figured. I'm gonna go to Clipperton, work those first 1500 and quit.

K3RLY

MARS

Harry Simpson A4SCF
c/o 73 Magazine
Peterborough NH 03458

Due to the lead-time necessary for publishing a national magazine, I am something like the moth – living in bathing suits in the winter and fur coats in summer! While still untangling the loose ends of last year, I must concentrate on new plans for making 1973 a banner year for all concerned with the various MARS programs! Let me begin with an apology for the delay in answering some of your letters. When Alice and I returned from our extended vacation we were presented with a stack of more than *two hundred* individual letters requesting MARS information! This, of course, in addition to our regular correspondence which normally runs about ten letters per day.

After the apology – thanks! Not only thanks to those of you who requested the information – but to

those wonderful members of Air Force and Navy-Marine corps MARS who volunteered information on their programs – I don't know what I said to bring on such a response – but I'm glad! For the first time since the beginning of this monthly effort I have actual proof that there *are* other programs than Army MARS!

First, a letter from W4NGU/3 with an outstanding proposal for CAP-Air Force MARS Coordination; next a friendly letter from Navy MARS member NØRRN (WB5AWA) listing these frequencies and times:

Transcontinental RTTY Traffic Net:
13,975 kHz, 100 wpm, about 11 AM CST

Eighth District Nets:
7375 kHz, SSB-CW, 24 hours
7495 kHz, RTTY, 60 wpm, 2300Z
4010 kHz, Louisiana Traffic Net, 0100Z daily

He also included a copy of DNC 8 (A), Mission and Policy – more about that later.

A Navy MARSgram from Canal Zone Area Coordinator NØGCZ: Canal Zone Navy MARS activity on upswing with daily circuits to the United States on TTY, CW and SSB. Phone patches will soon be routine but message traffic is our current speciality. If you want to send a message to the Canal Zone any MARS station should be able to route it. Two meter activity is also growing.

The message was forwarded by New Hampshire and Vermont Coordinator NØGBF, Karl W. Miles, Pead Hill Road, Wilton NH 03086. Another very nice letter from Bill Karabinus WA6RAM/NØQMY, listing west coast frequencies and times, and introducing 11th NAVMARCORMARS District Director Jack Hughes, 937 North Harbor Drive, San Diego CA 92132 – who can give full information on the program in that area.

AF7EJD, AFBØGSY and AFC4DTY all wrote very nice letters introducing Air Force Public Affairs Coordinator J. Harvey McCoy AF2IYX, 109 Willow Ave., Huntington NY 11743. Each gentleman added other information which will be passed along to you in the future. Finally, a letter from a fellow Army MARS member AD9SKU, Bob Ruggley of Cicero IL, with many kind words about our effforts – and, of all things – he enclosed eight (count 'em) 8-cent stamps to help out on our expenses! A feller like that should be rewarded, so I'm going to use one of the stamps to return the others!

It was a tough struggle, but we're finally off the ground, with contacts made for information from each of the MARS services. The mail has all been answered, the sun is shining, and all is right with the world! If you need information about Army, Navy-Marine Corps or Air Force MARS, I am now in an excellent position to supply it, and I promise to answer all letters promptly – at least until next vacation! Sincere thanks to each of you who took the time and effort to write – may your New Year be the best ever!

A4SCF

A WORRIED COMPETITOR?

Contrary to all the rumors, 73 has NOT annexed the telephone company. Even with the tremendous growth we have been experiencing, the task of doing such a thing is beyond our means . . . for a while.

But Ma Bell is worried! Not only have they started published a special interest magazine (see above), but their cover gives you that something-looks-awfully-familiar feeling. In addition, we recently received a copy of a top-secret executive memorandum calling for a dispatch of agents whose missions were to bring back FM and IC construction projects! (We *wondered* why that last visitor had such a questioning look on his face when he heard the word "antenna.")

In the face of all this we will make a prediction: Not only will we stand to meet the challenge that has been made – you can be assured that the second issue of this preposterous publication will never meet the presses.

73 GOES METRIC

Now that the U of S has decided to go metric, the very least 73 can do is try to keep up – and perhaps prod the other ham magazines into following suit – as they did with the acceptance of the IEEE standards, etc.

Besides that, we are already partly converted to metricity – right? Not too many of us have been active on the 250 foot band lately, though many are busy on the better known 75 meter band. Ditto the 70 footer, popularly designated 20 meters.

It will take a while before all of our articles are settled into the new nomenclature, but we'll try to convert as quickly as we can. Oh, there will be some areas that will take a while – like the 6-32 screw and its compatriots. That 32 represents 32 threads per inch – and in cement mixers that comes to about 12.6 and that is not going to be popular. Do you suppose the day will come when we do shift to metric threads? Or even metric heads?

REMEMBER:

1 in = 2.540 cm
1 cm = 0.3937 in

The Hamburglar
STRIKES AGAIN!

Milton L. Mitchel K5LKL lost out to a bit of unethical Christmas shopping last month. The Cloaked Claus walked off with an Eimac AF 68 Ser. No. 10888, Eimac PMR 8 Ser. No. 10918, and a M1070 power supply. An RCA model AR88 with a non-standard S-meter was also taken. Please contact Milton at Section A, V.A. Center, Temple TX 76501.

A Trio TR2200 Ser. No. 241969 was also politely lifted from the locked automobile of Ed Pores WA2ZBV. Anyone with information can reach Ed at 16 Dorchester Drive, Manhasset NY 11030.

Yaesu FT-101 No. 107036	WA2YSW	4/72
Standard 2m FM No. 102703	W6NPV	4/72
Drake ML2 No. 20189	WB2LLR	4/72
Standard SRC-806M No. 009210	K1TLP	5/72
Aerotone 6M 355LT, No. 685064	RR Police Grd.Ctrl.Trml. NYC	5/72
Standard SRC-806M, No. 102703	C. Mathias 3234 Coronado Ave Imperial Beach CA	5/72
Lafayette HA-410 No. 009210	WA2KDG	5/72
Coll., 62S1 No. 10728	MSU ARC E.Lansing MI	6/72
WRL Duo-Bndr 6010AT302	WA6FCY	6/72
HR-2A, 11 chan., 04-07152	WA1NVC	9/72
Swan Cygnet 270,No. 313022	K4ACJ	9/72
Collins Mic, Mod. MMx, No. 4294	K4ACJ	9/72
Heath HW-100 & AC PS	WA2JGP	10/72
Swan 270B No. M-385430	W6HST	11/72

Hello, "You-All", looks like it will be me running this column and the WTW Award from this date on. Let me introduce myself:
Name: Gus M. Browning
Call: W4BPD (and have signed well over 165 other calls from DX locations overseas.
Been A DXer since - Nov. 25, 1927
QSO's made: Total over 600,000
DXCC Nr. 4, WAZ Nr. 40, and lots of the other awards not all can be remembered.
Occupations: Editor & Publisher of The DXers Magazine, printer and Electronic Repair Shop.

Thats enough tooting my own horn. Plenty of time at later dates !

I need all the good, reliable DX tidbits, news, DXpedition plans, DX QSL info, and even any good photographs (in black and white - when possible) you may happen to have or get later on - They will to returned to you if you will mention "return to ???" on the back side of them.

You can send your info to me either at the address of this magazine or (to save time) send it to me direct at this address:
Gus M. Browning, W4BPD
Drawer "DX"
Cordova, S.C. 29039
Or if you run across something that's "red hot" and you think is important enough you could call me (please NOT COLLECT) at:
(803) 534-6485
You can call me anytime of day or night (as late as 2 o'clock A.M. - local time - I work that late every night here - 7 nights per week). In submitting info to me please keep in mind that I will have to have the news items in my hand no later than 3 days before the first of each month. This is being prepared on October 28th. as an example of how long before it appears in your magazine.

In case you havent heard yet, the year 1973 is being called "our year" by 73 magazine so Wayne (the "big boss") and I have come up with an award to celebrate, an award not too hard to make. All you have gotta do is to work 73 different countries in the first 73 days of 1973. We will call this something like "The 73 - 73 - 73 DX Award. So get the old rig ready to start on Jan. 1st, 1973. After you have worked your 73 different countries in the first 73 days of 1973 (thats the 14th of March) get three other hams to certify your log) send us the list of stations you worked, giving the dates and times, etc. of the QSO's. The Award may be either a nice certificate or lapel pin, maybe it will have a small "cost" tacked on to cover our cost or maybe even free (if Wayne can afford to lose on the whole thing !). Will let you know well in advance of the March 14th.

Future DXpeditioneers, prepare for "all events" because you will have "certain troubles" (other than the usual licenseing, customs, etc.) You will have QSL problems when you are back home, you will have a lot of such items as, time wrong, band wrong, even the mode and band will be wrong. Then you may have a "pirate" working the fellows at the same dates you are on, sometimes a few days before or after you are on. Be sure you have a good GMT watch or clock and set it right and be sure of your GMT date (this also goes for those back here working the DX stations, too). All the above came to mind when I received a letter from Jim, K9TZH after his operation at Market Reef, where he operated as OJØ SUF. A portion of the letter quoted: "OJØ SUF QSL INFO: Fellows I am very sorry that there has been such confusion regarding the Market Reef Expedition QSL's. When I left Finland, all was in order but since that time, problems have developed concerning financing the 6000 cards. Have just received a letter from OH2BHU, who stated that the cards have *finally* been ordered and will be coming out very soon. Anyone having problems getting a card for their QSO, please write me and I will do everything in my power to get the contact confirmed. This includes fellows who have received their own cards back marked "Not in Log".

I would like to emphasize this is not a request for $!"
Jim says in the letter, "if I had only knew then, what I know now". after mentioning other problems.
NOW FOR THE WTW AWARD
At the present moment all the info and present status of the WTW is in the hands of Dave, K2AGZ and I am QRX for him to send all the info, etc. down here so that I can arrange it all in the files and then get going on the project again. I hope to soon receive this all from Dave and get going again. I suggest that all confirmations be sent to me direct instead of to 73 Mag. It will be more quickly handled and be less chance of your cards being lost, etc. I do very strongly suggest that you send your cards by "certified" (cheaper), or via Registered mail and include enough (either stamps or money) to return your cards by "certified mail" plus of course the usual parcel post costs and naturally the WTW fee of One Dollar (to partly cover our costs). Be sure to list every card in the order they appear in the DXCC country list, giving date, etc. of the contact. Remember we will keep this list you send us. You had better make yourself up a duplicate list to keep for reference purposes at later dates when you add new countries to your standing in the WTW. Remember there are three awards, the WTW-100, WTW-200 and WTW-300 and these can be earned on CW and then the same for all PHONE. Will be telling you more about this from time to time.

We are thinking about maybe giving nice Lapel Pins for the 200 and 300 plateaus of our WTW. I wonder when the ARRL will start something like this, too ? And while I am "wondering", why not also wonder about the overall viewpoint of DXing in general ? For instance, why not *more countries* ?, YES that's what I said "more countries" ! I have not met anyone yet who really has complained that there are "too many now". This word "countries" are used very loosely when refering to our DX awards. Except WTW, which stands for Worked The World, certainly a more descriptive group of words when talking about our kind of DX. I think it's time for Big Brother, the ARRL to do something about their DX Award set-up, give some pins for the 200 and 300 brackets, give us some new countries, cut that 250 miles separation between islands for a starter - OR - better yet - START SOMETHING BRAND NEW. (all of which I doubt they will do.) With computers being used these days even by some of my small grocery stores, I am sure that this could be done at a very reasonable price. They of course would be able to use the computer in many other ways when it is put in. This is nearly 1973 (73 Magazine's) and times are changeing rapidly and I think ARRL will have to do the same to "keep up to date" with the rapidly changeing world !

I know that I will receive many letters telling me to not "rock the boat", you can't fight the establishment, etc. My answer to these is all the same, Ole Buddy, you have your ideas and I have mine and if you want to "air" your ideas we have the "LETTERS" page in 73 for you to use (I also have "Letters to the editor" page or pages (if necessary in my little DXers Mag.) They are yours to use to let the other fellow have your viewpoints. All I want to do is to have MORE DX for the boys to chase, giving them something to do these long winter nights coming on us now.

I wonder if there are still some of you out there that have not yet tried makeing some of these new "gadgets" using these new IC's ? It took me ONE HOUR to build a very FB 10 meter pre-amp using a Motorola type 1590G and it gave a 50 db gain with less noise than I could hear from my Collins 32S-3. Have built up a number of very FB other little "goodies" (quite useful, "gadgets".) All which will get you started with Solid State, you may as well face it fellows, solid state is with us and the days of hot, noisy, inefficient, etc. is about over. You are never too old to learn !! 73 Magazine will give you plenty of these little "goodies" to build. Try a few of them and the Old Bug will bite you again and you will again become a ham like you used to be ! - Remember ??
That's it for this month,
73 es DX, de BPD

SSTV PROGRAM

Presented by John Smith K3SLJ.

SOCIAL EVENTS and CONTESTS

CONTEST EDITOR NEEDED!

There is another aspect of amateur radio that we would like to cover regularly in the 73 newspages – contests and certificates. It is possible that we might be receptive if someone who was seriously into these things offered to keep the 73 readership informed.

We might even be able to add some pecuniary interest to your amateur radio hobby.

If you have better than average connections on keeping up with certificates and awards, and are interested in preparing capsule facts on them for the 73 newspages, drop a line to us.

Ditto contests. Readers would like to know what contests are being run, when and enough data to get started in them or send for full rules. We do want to leave CQ as the force for exhaustive details on contests and just bring a synopsis to 73. Anyone with good bona fides interested?

LIFETIME CANCELLATION AWARD
73
Be it known by these presents that
has provided satisfactory proof to the staff of 73 MAGAZINE

NEW CERTIFICATE AVAILABLE

Now and then – it certainly doesn't happen often – but occasionally someone of particularly low moral turpitude manages to become a subscriber to 73. The Lifetime cancellation award is reserved for those who, by their rottenness, richly deserve it.

None have yet been issued; however several amateurs are definitely up for serious consideration. Unless psychiatrists are able to give them emergency mental repairs, these sick-o's will be early winners.

3RD WORLDWIDE SSTV CONTEST

The third worldwide contest for SSTVers is being sponsored by cq electronoca Magazine. The operating times are 1500–2200 GMT Feb. 10, and 0700–1400 GMT Feb. 18. Plan to use all authorized frequencies on 80 through 10 meters. Each two-way exchange counts one point with a multiplier of 10 for each continent and an additional multiplier of 5 for each official ARRL country. The only exception is that each VE and W call area will count as a separate country.

Logs must contains Time (GMT), Frequencies, Data, Call sign, No. sent and received, Country multipliers, Points and final score. They must be received by Prof. Franco Fanti, via A. Dallolio 19, 40139 Bologna Italy before March 20, 1973.

NOTE: All contacts must be made via SSTV *only*. Use of any other mode of transmission before, during or after the Slow Scan exchange is not permitted, and will cause your log to become invalidated.

VHF CONTEST

Worlwide VHF Activity 1973 – 3PM local March 10 to 10PM local March 11. Purpose: To keep VHF bands active, allow rig testing, allow hams to get acquainted with fellow VHFers. Exchange call letters, county and state. Count contacts with mobiles in each county worked. Mobiles can work a station once from each county of mobile or portable operation. Let's see some mobiles. Scoring: Multiply number of contacts times number of counties worked times number of states worked. Awards: Certificate to each station scoring 100 points on six or 50 points on two meters. Certificate to the top station in each state regardless of score. This applies to each band of operation. Each band is a separate entry and a station can enter one or both bands. Logs should show time band mode and exchange info. Mail logs by April 15 to WA3NUL, Box 1062, Hagerstown MD 21740.

WHEATON HAMFEST

The Wheaton Community Radio Amateurs will hold their 11th annual Mid-Wanter Swap and Shop on Sunday, February 11, 1973 at the DuPage County Fairgrounds, Wheaton, Illinois. Hours: 8:00 AM to 5:00 PM. $1.00 Advance/$1.50 at the door. We are expanding to two buildings this year. Refreshments and unlimited parking. Bring your own tables. Free coffee and donuts 9:00 – 9:30AM Hams, CB'ers, electronic hobbyists, friends and commercial exhibitors are cordially invited. Write W.C.R.A., Bill Rambox, WB9AVD, P.O. Box QSL, Wheaton, Illinois 60187 for information.

TROPICAL HAMBOREE

Announcing the upcoming Tropical Hamboree/ARRL Southeastern Division Convention Jan 20–21, 1973, at Miami Municipal Auditorium, 499 Biscayne Boulevard, Miami, Florida. Further information may be obtained from Evelyn D. Gauzens, W4WYR, Chairman, c/o Dade Radio Club, P.O. Box 73, Biscayne Annex, Miami, Florida 33152.

BRISTOL 73 ACTIVITY CONTEST AND AWARD

Contest to run from 1st January 1973 to 31st August 1973, and is open to all licensed radio amateurs in the world, who are invited to make contact with Bristol, England. Bristol is defined as within Postal Districts 1 to 20 inclusive (BS1 to BS20).

A case of sherry donated by a famous firm of Bristol wine merchants will be presented to:

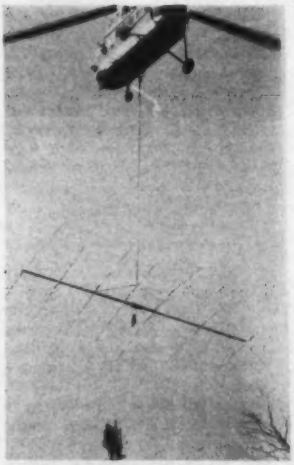
1. The highest scoring station outside the U.K. call areas.
2. The highest scoring station within the U.K. call areas but outside Bristol.
3. The Bristol station making the largest number of contacts with participating stations.

COLLINS UPDATE

To cover the new phone frequencies without having to switch down to the next lower 200 kHz segment on your rig, replace your hf oscillator crystals with the following: 80M-6855 kHz, 40M-10255 kHz. This will allow you to tune 200 kHz segments of 3700–3900 kHz and 7100–7300 kHz. *Thanks to W4NJF.*

.52 SIMPLEX?

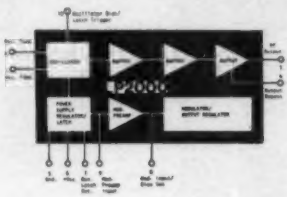
The IRC bulletin announced the topic of .94 repeaters with the heading "KA-BAM!" And that's about what happened at the council meeting October 15, 1972, at Michigan City. Many points about the pros and cons of .94 repeaters were brought out, and opposing viewpoints were heard from simplex and repeater operators alike. It might be best said that no one really knows the ultimate solution, but the Council has voted to endorse .52 as the national calling frequency (as have other states), and .46 as the Indiana spx. channel to be used as an alternative to .52 and for emergencies. While this does not solve the .94 problem, it at least takes the pressure off the Council to act in a negative direction, and is a hint to simplexers that .52 and .46 are good alternative choices to .94.



What a way to install an antenna! This Wilson Beam was recently installed by Peter Williamson in Augusta, Maine. He reportedly had to remove a tree for complete clearance. What did he use for that . . . dynamite? (Kennebec Journal photo by Veilleux)

NEW PRODUCTS

TRANSMITTER ON A CHIP



Someone eventually had to do it – and they did. Lithic Systems has announced a complete AM transmitter on a tiny IC chip. Designated the LP2000, it is capable of 50 MW output on 10 meters when fed by a 12V supply. Operation on 6 meters is also possible with slightly reduced output.

The block diagram shows that the chip isn't a simple oscillator/modulator as you might expect. Not only does it have two buffer stages between the oscillator and output stage, but it incorporates a power supply regulator and an audio preamp that is sensitive enough to be driven by a small speaker voice coil. Pretty sophisticated for an AM transmitter! T/R switching is accomplished by a latch trigger so the circuit can remain connected to its power source at all times.

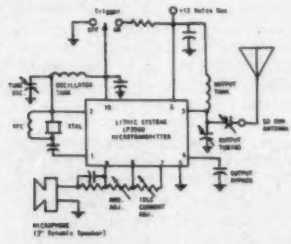


Fig. 1. Schematic of the complete transmitter.

You can't put everything on a chip (yet), so naturally a few extra components are needed to get things working. Not many though – two coils, an overtone crystal, two resistors and a few capacitors – no trouble should be had by anyone trying to package the circuit in weird places (like your wristwatch . . .or an enemy's ham sandwich!). No kidding, this little transmitter is bound to start showing up everywhere as a bug. Another possibility is a remote burglar alarm small enough to mount right inside a door knob! Power requirements are +5 to +15V so those tiny, aspirin-size batteries are a natural for the power source. Current drain at 12V is 28 mA.

Lithic Systems is hard at work developing VHF FM and even SSB transmitters similar to this one. *Those* are certainly going to revolutionize things. Who is going to manufacture the first 2 meter FM nameplate?

Contact *Circuit Specialists, Box 3047, Scottsdale AZ 85257* or watch their ads.

POWERHOUSE

The ALPHA 77 has got to be *the* linear for the discriminating amateur who demands quality and perfection for his shack. It is not just an ordinary linear built for ordinary ham use. It features heavy duty construction and is designed to operate at 3000 watts PEP phone input on a continuous duty basis. At the legal limit of 2000 watts (taking into consideration the intermittent type of service that occurs in the normal SSB operation) this amplifier is practically snoozing.

It employs a single Eimac 8877/3CX1500A7 ceramic-metal, grounded-grid triode that is air cooled by a computer grade thermostatically controlled blower. This tube has a rated dissipation of 1500 watts and can be driven to the limit for ham use by only 50 watts of drive. This makes it compatible with practically any exciter on the market.

The overall design stresses safety and sensible operation. When turned on, a step-starting relay system gradually applies power to prevent current surges and relay arcing. To keep everything in check while operating, full metering is provided. Besides the 10A meter for continuous monitoring of plate current, a second meter can be switched to read plate voltage, grid current, and forward or reverse rf power output. Yes . . . the ALPHA 77 has a built-in direct reading 0–5000W wattmeter! An additional feature is the grid excess current circuitry. The grid relay automatically kicks-out when the final tube is either overdriven or underloaded. Besides assuring full tube life, the relay also protects against accidental flat-topping and a possible blown input circuit.

Continued on page 136.

AMATEUR RADIO AND THE I.T.U.

A. Prose Walker, Chief
Amateur and Citizens Division
Federal Communications Commission

Mr. Walker's speech was given before the Pacific Division Convention, ARRL, October 15, 1972 at San Mateo, CA, and at the Southwestern Division Convention, ARRL, October 21, 1972, at Santa Maria CA.

Although there are many other subjects of immediate importance to amateurs, I would like to discuss today the question of the allocation of amateur bands. There is no more urgent and time-consuming task, in my opinion, than this one. And although the mechanics of the next step in the process have not yet been brought out into the open, that is no reason not to begin our preparation for what could be the greatest opportunity amateur radio will have in your lifetime and mine to obtain additional amateur bands in the HF region from 3–30 MHz.

We are not yet at the point where any phase of amateur radio can be substituted for the activity handled on a daily basis on our main bands from 80 through 10 meters. I'm not sure that any phase could or should be a substitute for this. If those bands were taken away, we might or might not survive. For as long as I have been an amateur, the philosophy of our approach to allocation conferences has been primarily one of defense of our existing bands; essentially a negative philosophy.

Over the years, our allocated bands have been gradually whittled away:

160 meters taken away as an emergency war measure 31 years ago and returned only in minute amounts since then;

Eighty meters shared with broadcasting, fixed and mobile and except in Region 2, drastically reduced in width as an amateur band.

Forty meters has become such a shambles of its former self that it is hardly recognizable anymore as an amateur band . . . as indeed it is NOT except during certain times of the day and seasons of the year and sunspot cycle. We have 300 kHz to use, if we can, but the rest of the world has only 100 kHz *"exclusively amateur."* Listen some morning, wherever you live, and see how "exclusively amateur" it is from 7000–7100 kHz.

In 1947 at Atlantic City we lost the top 50 kHz of our *twenty meter band* to the Fixed Service, and in certain countries of the world they also use from 14250–14360 officially and other parts of the band, unofficially.

Fifteen meters is definitely a PLUS on our side but it hardly makes up for all the other minuses we have incurred over the years . . . we got the eleven meter band and then lost it to the Citizens Radio Service.

Ten meters is probably in reasonably good shape, but we did lose the top 300 kHz at Geneva in 1959, primarily to the meteorological service for their high altitude weather balloons.

The World Administrative Radio Conference (WARC) held in 1959 was the last one to deal with the allocation of the HF spectrum on behalf of all the various services. There have been individual service conferences since then, but they have not been empowered to re-allocate or reassign except within the bands of frequencies already in the table of allocation contained in the International Radio Regulations. The head of the United States delegation to the 1959 conference was the late FCC Commissioner T. A. M. Craven, an engineering expert who had grown up with the telecommunication industry. He was not an amateur himself, but he had associated with many throughout his career. He had a keen understanding of the value of amateur radio to our country. It is a tribute to Commissioner Craven that the amateur service fared as well at that conference as it did. We might well have lost 200 kHz of 40 meters, and 240 kHz of 80 meters, had it not been for his foresight in handling the negotiations on those bands.

I hope that by now, you and I are in the same situation as the farmer and the mule which he had to hit across the head with a two by four in order to get his attention. If I have your attention, let me discuss with you my appraisal of the frequency allocation picture for the Amateur Service. I shall go into detail how frequencies are obtained and what should be expected of amateurs whenever a reallocation conference is called by the ITU. I shall predict the amateur population by 1980 and the amount of spectrum that will be required to accommodate them. If I seem to lend a measure of urgency to the subject, it is intentional, *because I believe the subject is terribly important to amateur radio worldwide.* If I can convince you, perhaps through your agreement, you can initiate appropriate action through your representatives.

A short time ago we were asked to predict the number of amateur stations in the world by the year 1980. This is difficult if for no other reason than the fact that we don't really know how many we have at present. Such figures are quite vague for certain countries of the world. Also the prediction depends on the assumptions you make as to what factors influence the growth and in what proportion. The factors are different in various countries. I won't attempt to go into detail. We know that in certain countries there are rather startling increases in the number of amateur stations. We think we know what has brought about such increases, and what might do the same in our own country. Taking these aspects into

consideration and using some black magic, we arrived at a worldwide amateur population figure for 1980 of between 600,000 and 800,000. Even allowing for some discrepancy in these figures, it is obvious that if anywhere near that number of amateurs has access to our bands around 1980, particularly the HF bands, there is going to be much greater congestion than we have at present. Suppose we increased the amateur population of just the United States by around 50%, what do you think the bands would sound like on a weekend? Add to that figure another hundred thousand or so amateurs scattered around the world, and I think you will agree that we could have real QRM at peak operating hours. Please don't draw any wild conclusions from this discussion that the FCC is about to do something drastic that will cause the growth of amateur stations to mushroom, as it did in the Citizens Radio Service from around 40,000 licensees in 1958 to a present total figure of about 815,000.

The most obvious solution to any problem of frequency congestion is additional frequency space. Let's examine what is involved. Do we say to the FCC,

> *"We need more spectrum . . . how about assigning another 100 kHz on the top end of twenty meters?"*

No, the FCC can't do that because this is an international problem that can be solved only through the I.T.U. The United States is one member administration of that body. What is the mechanism of getting our 100 kHz? First a World Administrative Radio Conference must be called under the provisions spelled out in the Montreaux Convention. Is that apt to be done? I say yes, but don't ask me exactly when. *But whenever it comes, we must be ready and that takes a long time.*

How do amateur frequency bands get established and put into the Table of Frequency Allocations? Member countries of the I.T.U. such as the United States, Australia, New Zealand, Japan, the Soviet Union, France and any others, submit proposals for utilization of any part of the spectrum under consideration. These proposals are determined *individually* by each country and submitted in advance of the conference to the I.T.U. At the conference, an allocation committee is formed, which is further divided into sub-committees to consider the previously submitted proposals for use of particular portions of the spectrum.

You can readily understand that if a majority of the members of such a committee are in favor or against a proposal, its chances of success or failure are correspondingly equivalent. How do we get enough countries to agree with the amateurs' position seeking more allocations? *We start well ahead of time and obtain concurrence of governments* throughout the world *prior to the conference,* to *include the spectrum needs of the Amateurs in their proposals to the I.T.U.* This certainly includes our own government which has consistently championed the cause of Amateur radio throughout the years. It also includes as many other countries as possible, because decisions are taken on the basis of a majority vote. *Without support in committee and votes on the floor, the proposal fails of adoption.* It's that simple.

Is such an endeavor within the potential of radio amateurs? Again I say yes. It won't by easy, and there's no guarantee of success. But I keep repeating that we *can't afford not to do it!* If there was ever a golden opportunity for Amateurs to do something about their HF allocations, NOW IS THE TIME.

In all likelihood, there will be another WARC dealing with the HF spectrum within the current decade. If not, derogations of the Treaty may pre-empt portions of the spectrum before a conference can be called. Let's just assume that we might have one within the next 6 or 8 years. What should we do between now and then? Is it too soon to be stirring ourselves? I think not. Let me tell you why.

You all know, with the advent of satellites, what has transpired in telecommunication during the past decade. Many services are in the process of transferring their operations from the HF spectrum to the GHz spectrum of satellites or onto cables. Notable among these is the International Fixed Public Service which is transferring its operations about as fast as feasible. Others include the Maritime and Aeronautical services in varying degrees. The reason, reliability. Who will occupy the portions of the spectrum which inevitably will be vacated by many of the Fixed Service transmitters? Probably a host of users not yet evident will file claims on the spectrum, plus the *many countries* which *still require HF* because they have no cable terminal nor an earth station for satellite operation. *Those who are successful in obtaining spectrum space at the next WARC will be those who have prepared their positions carefully with convincing justification . . . a professional effort* worthy of consideration at highest levels of government. It won't be a "shoo-in," believe me. Undoubtedly the HF broadcasters will be after additional space . . . something like ten bands 500 kHz wide. What should be amateur position be, both domestically and internationally? It has to be the same, because our HF bands all have long distance progation characteristics in varying degrees depending on propagation phenomena.

What I shall now propose is not an FCC plan, but one that I personally would suggest as a desirable approach. You may call it what you will, but I emphasize it has no sanction by the FCC. It has five major points.

First, I urge that the *amateur satellite program be expedited* with the goal of having a near-synchronous, "semi-professional" amateur satellite in orbit during the early part of 1976. Without going into the many details involved, this could have a tremendous effect on many nations of the world. If you have the "bird" operational, a team of competent amateurs with a portable earth station could travel to selected countries for demonstrations and educational purposes, bringing to their realization what amateur radio can do for them through their young people. Use of the amateur satellite would be a most dramatic means of calling this to attention. Aside from the educational benefits of the satellite in amateur communication, such a program would almost certainly make friends for the Amateur Service . . . something which we need desperately as evidenced at the last WAR-ST. I repeat, the ITU makes its decisions via the voting route, and the United States has 2 votes; one for the U.S. proper and one for the Territories. When the chips are down, *it's the votes that determine who gets what and how much!* No majority in the voting, no allocation.

Second, I would formulate a high frequency allocation program for our future needs, assuming that the prediction figures I mentioned earlier will prevail. In this let's not be mice, let's THINK BIG! *Perhaps we won't get all we want, but let it not be because we didn't try!*

a) Let's get 160 meters returned.

b) Work out a program aimed at making the entire 3.5–4.0 MHz band *exclusively amateur, worldwide.*

c) Work closely with other users of the spectrum in the area of 7 MHz, especially the HF broadcasters, and make a tough, determined effort to not only unpollute our existing 40 meter band, but expand it to encompass 7000–7500 kHz, *exclusively amateur, worldwide.* It's just possible that under some conditions, HF broadcasting would vacate our 40 meter band.

d) Go after a new exclusive amateur band from 10.5–11.0 MHz.

e) Work for expansion of 20 meters up to 14.5 MHz on the high end, but at the very minimum attempt to

obtain the return of the 50 kHz we lost in 1947 . . . all of it *exclusively amateur.*

f) In the area of the spectrum from 17–20 MHz there are 2.3 MHz now allocated to the Fixed Service. How about a new band in this area from 17.5–18.0 MHz?

g) Although 21 MHz is not as critical as some others, at times it gets congested. Why not try to expand it up to 21.5 MHz on the high end. This would be at the expense of HF broadcasting, but they might agree to slide up the spectrum an equivalent amount.

h) In the area above our 15 meter band, there is almost 2 MHz now allocated to the Fixed Service. Why not go after a band from 23.5–24.0 MHz.

i) Ten meters is wide enough and I would not suggest any further expansion there with the possible exception of getting back the 300 kHz we lost previously.

If we could obtain the foregoing, we would have *bands about every three MHz throughout most of the HF spectrum,* and could follow the propagation curves as the MUF changes throughout the day and night.

Third, we should be *organizing a professional domestic, U.S. team* to investigate and coordinate information on specific areas of the spectrum; analyze data that could be obtained on utilization of assigned allocations by the various services; dig out information on new potential users of the HF spectrum that may not have come to the surface yet; *prepare a professional position paper for use at the appropriate time* within this country; and work thoroughly, with the foregoing as a basis, throughout the preparation period when the position of the United States is being formulated. That time has not yet come, but when it does *we should be ready to participate armed with proposals, facts, and figures,* insofar as possible to get them, in support of our desires. That is the only way to deal with professional allocation people, who are notably lacking in sympathy when it comes to allocation of the spectrum.

Fourth, extraordinary effort should go into *liaison and coordination* of whatever program is agreed upon, with the most influential and important IARU member societies. The same goals, if proposed throughout the world on a coordinated basis could accomplish much more than a haphazard effort, no matter how well prepared the program might be. *If even a dozen of the 125 countries which usually take part in such deliberations,* would propose the same program for amateur allocations *it would* auger well for success. The *important thing is to obtain each country's acceptance of the amateur position prior to submitting its national proposals to the I.T.U.* Usually, once a delegation gets to the conference it is too late to change position. This simple statement of affairs is miles from its accomplishment. It would require at least one and perhaps several teams of people to travel throughout the world to explain and urge the adoption of the position to IARU people, and provide them with assistance in justifying the program to their own governments. No one but amateurs in individual countries can do that job. *We have well known people in our ranks – use them!* Maximum assistance should be given them through prepared material which could form an equivalent basis for justification that we would use in this country, or modified as circumstances indicate desirable. Certainly conditions and viewpoints will undoubtedly be different in various countries of the world, but that should not dampen our effort, *merely sharpen our perspective.*

And finally, our selected group of amateur experts, *professionals in telecommunication,* should be our representatives at the WARC. As many as reasonable should attempt to be appointed to their national delegations for purposes of liaison with their own governments. The composite team should be directed by someone with experience in international allocation matters, such as Tom Clarkson of New Zealand, ZL2AZ, so that a coordinated team effort can go into the conference work itself, in the committee and sub-committee discussions, all *on a professional level,* to the credit of the Amateur Service.

The program I have outlined may not be acceptable in all details to everyone, but at least it could be a beginning of the formulation of a program. It would take money. It would need professional manpower. It would require time. And above all it would need confidence in the purpose of the effort, with sufficient desire to succeed and an understanding of the difficulties to not become discouraged when the going got rough. In my opinion, the result will be a measure of the amount of effort which the amateurs of the world are willing to put into it. There is no guarantee of success in any degree. But if we are ever to have a chance to obtain additional HF allocations, it seems to me the time to begin is NOW!

You may well ask the question: "What is the alternative if we do not obtain additional spectrum space and our population expands as predicted?

There is no answer that any one individual can provide, and however it is answered it would have to go through rule making procedures of the Commission. But I think it is only logical to conclude that as the number of amateurs using wide-band emissions increases, something will have to be done to reduce the interference potential of amateur signals. There are several avenues of approach. One might be to reduce power in particular ways for various classes of stations. Another might be to reduce the occupied bandwidth, giving some kind of incentive to the signal which occupies the least practicable amount of the spectrum. Another would be to reduce or eliminate wide-bandwidth emissions, or restrict them to the highest class licensees, as was formerly the case on 75 and 20 meter phone. We probably should encourage more CW even though many people consider that to be an archaic form of communication. But a *CW signal occupies the least amount of spectrum and if we get too numerous for our existing bands, as we now use them, it might be that CW would again become the primary mode of communication,* rather than SSB. I might say that we well may be approaching this condition now. Certainly we see no technological breakthrough on the horizon which is of the same magnitude as the single-signal receiver of 40 years ago; or single sideband which was made popular shortly after WW-II or other development of like nature.

I consider it my responsibility to have pointed these matters out to you today, and I urge serious consideration by your representatives of the proposed action. The talents among the amateur ranks are more than adequate to achieve the degree of professionalism required for this task. It seems to me, that they must be sought out and used, not on the basis of winning a popularity contest but because they are professionals and therefore what they can do *for* amateur radio.

The other day in doing some research on the evolution of spectrum management, which I shall discuss before the Radio Club of America in New York City, I ran across a statement which was used to describe the results achieved by the United States at the recent WARC-ST. It is so apropos to my thoughts on the subject I have discussed that I would like to quote it here:

"Although the United States went into the Conference with strong opposition to some of its proposals, the results were most favorable and proved the value of thorough preparation, advance coordination and a delegation composed of experts in all facets of telecommunications."

SNEAKY FCC PROPOSAL TO END AMATEUR RADIO*

The FCC almost got one by all of us! And this one is a beaut. This proposal would make it extremely difficult to put up a tower or a mast for your antenna. Anything over 20 feet above your house would require a lot of paperwork, authorization, an okay from the neighbors – the works.

The deadline for official comments has passed by, but we are asking for an extension of the comment time since this docket was not sent to us when it was released and amateurs have had no opportunity to see or consider the impact of this far reaching docket.

I want to thank Steve Murray K1KEC for bringing this corker to our attention.

Read through the text, please. Talk about it at your club – and file a comment. Please, please file a comment. Amateur radio comes under the Safety and Special Radio Services – so this docket means US! If this docket doesn't get you excited then you need some help to get you back to life again. It is so incredible that it seems like a bad dream – but it is here and it is about to be passed into law.

PETITION: To extend the time for comments on Docket 19555 until February 28, 1973.

This docket, which proposes profound changes in the whole fabric of amateur radio, has not been brought generally to the attention of radio amateurs and they have not had an opportunity to understand or comment on the docket. This is manifestly unfair.

In order to permit the publication of the entire text of the docket and allow time for its delivery, reading, discussion and comment, much more time is needed. The next issue of the amateur radio magazines in which the docket could be published would be received in January. This would make a cutoff date for comments of February 28, 1973 practical.

Please extend the time for comments on this docket.

Filed by Wayne Green
W2NSD/1

Docket No. 19555

In the Matter of Implementation of the National Environmental Policy Act of 1969 – Notice of Proposed Rule Making – Adopted July 24, 1972; Released August 1, 972 – By the Commission: Commissioner Johnson concurring in the result; Commissioner Hooks absent.

1. Our purpose herein is to implement the National Environmental Policy Act of 1969, 42 U.S.C.A. 4321-4347, and particularly Section 102(2)(c) of the Act, 42 U.S.C.A. 4332(2)(c). (Heretofore, the Commission has considered environmental factors on a case-by-case basis, pursuant to an initial policy judgment that this was the better and more appropriate means of implementing the statute, in view of the relatively limited environmental impact of Commission actions. Though we have not decided many cases in which environmental questions were at issue, such questions have been considered when they were present. See, e.g., Amendment of FM Table of Assignments, 25 F.C.C. 877, 1970. In the light of recent court decisions, however, we have reassessed our initial position and are now persuaded that it is advisable and desirable to issue specific implementing regulations.)

2. In drafting the rules, careful consideration has been given to Guidelines issued by the Council on Environmental Quality. In its regulatory activities, the Commission approves or disapproves of applications which may involve construction projects by others which may have a significant effect on the quality of human environment, but does not itself engage in construction activities. In processing the hundreds of thousands of applications which are filed during a given year, it is almost totally dependent on information furnished by the applicant and others. Whether the criterion is efficiency, practicality or fairness, it is preferable to have all of the information and arguments from all interested persons before a judgment is made. This is particularly true of many environmental considerations, which have only recently been introduced as factors in the decision-making process. Thus, we propose (where there appears to be significant environmental effect) to transmit the application and related papers (including an environmental report prepared by the applicant) to the expert agencies, and to elicit environmental comments from those agencies and the public on the basis of those materials. A detailed environmental statement would be prepared following submission of agency and public comment. This seems to us the best way to assure full and fair consideration of the question of environmental impact.

3. Our purpose has been to fully implement both the letter and spirit of the environmental statute, consistent with procedural safeguards set out in the Administrative Procedure Act and the Communications Act, and with no greater application processing burden or delay than is necessary. The rules provide for the regular input of environmental data which will facilitate the identification and considera-

*As we now know it.

tion of environmentally significant factors. They provide for comment by interested individuals and organizations and by expert governmental agencies, and for their participation in Commission proceeding. They provide for the consideration of environmental factors at the same time and in the same way as other factors pertinent to a public interest determination are considered, except that they provide for the preparation of a "detailed environmental statement" following comment by interested persons and expert agencies and prior to action, as required by the environmental act.

4. The rules apply to applications involving construction. Attention is directed to the fact that the Commission has not for some years required applicants for authorizations in the Safety and Special Radio Services to file an application for authority to construct prior to construction of station facilities. See Section 319(d) of the Communications Act, 47 U.S.C. 319(d). In those services, therefore, the proposed rules are made applicable to applicants and applications for station authorizations rather than applications and applications for authority to construct. For the most part, it is anticipated that the approximately 550,000 Safety and Special applications filed annually would involve minor construction having no significant environmental effect. However, Safety and Special applicants should consider environmental factors prior to construction, since construction without prior consideration of the environmental consequences and Commission authorization would prove fruitless if the Commission should subsequently find it necessary to deny the application for license on environmental grounds.

5. Authority of the proposed rules is contained in Sections 4(i), 4(j), 303(r) and 309 of the Communications Act of 1934, as amended, 47 U.S.C. 154(i), 154(j), 303(r) and 309, and in the National Environmental Policy Act, 42 U.S.C.A. 4321-4347.

6. Pursuant to applicable procedures set out in Section 1.415 of the Rules and Regulations, 47 CFR 1.415, interested persons may file comments in this proceeding one or before September 29, 1972, and reply comments on or before October 30, 1972. In accordance with the provisions of Section 1.419 of the Rules and Regulations, 47 CFR 1.419, an original and 14 copies of all comments and reply comments shall be furnished the Commission. Comments and reply comments will be available for inspection in the Commission's Broadcast and Dockets Reference Room. All relevant and timely comments and reply comments will be considered by the Commission prior to final action in this proceeding. In reaching its decision, the Commission may take into account other relevant information before it in addition to the specific comments invited by this Notice.

Federal Communications Commission
Ben F. Waple
Secretary

APPENDIX

Part 1 of Chapter I of Title 47 of the Code of Federal Regulations is amended by adding a new Subpart I, to read as follows:

Subpart I – Procedures Implementing the National Environmental Policy Act of 1969.

§ 1.1301 *Basis and Purpose.*

The provisions of this subpart implement the National Environmental Policy Act of 1969, 42 U.S.C.A. 4321-4347.

§ 1.1303 *Scope.*

The provisions of this subpart apply to all applications filed with the Commission involving the construction, abandonment, or razing of a structure. They also apply to applications for license for new or modified facilities in the Safety and Special Radio Services. The term "application (or applicant) for authority to construct," as used in this subpart, shall encompass the abandonment or razing of a structure and an application (or applicant) for license for new or modified facilities in the Safety and Special Radio Services.

§ 1.1311 *Notice of proposed construction.*

(a) An applicant for authority to construct is required to provide notice to appropriate persons or organization if it appears to him, or to the Commission upon review of his application, that the proposed construction is likely to involve a significant environmental problem and that notice is likely to provoke comment which would be helpful in assessing the effect of the proposed construction on the quality of the human environment. The notice shall state the nature and location of the construction and shall invite comment to the applicant on environmental considerations.

(b) Where notice is required and written comment is requested. 30 days shall be allowed for comment. Comments received shall be considered by the applicant in assessing the effect of the proposed construction on the quality of the human environment pursuant to the provisions of §§ 1.1313–1.1317. In normal course, notice should be given, and procedures for the consideration of environmental effect should be completed, before the application is filed, and written comments pursuant to the notice should be submitted to the Commission with the application. However, the applicant may, upon a showing of good cause, defer notice until after the application is filed. In that event, the applicant shall state in his application that he is seeking comment on a deferred basis, and action on the application will be deferred until applicant has given notice and complied with the provisions of § 1.1313, § 1.1315, or § 1.1317, as appropriate.

(c) The form of the notice and the persons or organizations to whom it is given will vary depending on the nature and scope of the construction project. The environmental effect and the sources of useful comment could be strictly local or could extend to a number of States. In a given case, for example, it could be appropriate to post notice at the site, to discuss the matter orally with neighboring property owners, or to raise it at a meeting of a community group. In another, newspaper or broadcast station notice could be appropriate. In still another, it could be appropriate to contact State or Federal environmental organizations and Government agencies which may reasonably be considered to have an interest in the environmental effect of the project. The form and extent of notice is left to the judgment of the applicant, subject to review by the Commission.

§ 1.1313 *Applications entailing expenditures of less than $100,000.*

(a) If an application for authority to construct entails expenditures of less than $100,000, if the applicant has considered the matter and has concluded that the construction will have no significant environmental effect, and if the applicant has received no significant objection to the construction proposed in the application, he may, as an alternative to filing a preliminary or detailed environmental report (see § 1.1315 and 1.1317), submit with his application a simple statement to that effect: *Provided, however,* that this paragraph shall apply only where prior public notice of the filing of the application is given by the Commission. See 47 U.S.C. 309(b).

(b) The Commission may, upon review of an application filed in accordance with paragraph (a) of this section, require the submission of a preliminary or detailed environmental report.

§ 1.1315 *Applicant's preliminary (short form) environmental report.*

(a) Except as provided in this paragraph, all applicants seeking authority for construction (and all applicants seeking authority to discontinue, reduce, or impair service to a communi-

ty, or part of a community, which involves the abandonment or razing of a structure owned or utilized by the applicant) shall file a preliminary environmental report. A preliminary environmental report need not be filed with the following applications unless the applicant has been required to provide notice of proposed construction under § 1.1311:

(1) Applications accompanied by the statement provided for in § 1.1313 or by the detailed environmental report provided for in § 1.1317.

(2) Applications for authority to mount an antenna on an existing antenna tower, provided the height of the structure is increased by no more than 20 feet or by no more than 10%, whichever is greater.

(3) Applications for authority to construct an antenna structure which will extend no more than 20 feet above ground or natural formation or above an existing man-made structure.

(4) Applications proposing to locate antenna structures within an established antenna farm.

(5) Applications which involve the attachment of additional wire or cable to existing telephone poles and do not involve the erection of new poles.

(6) Applications involving the installation of additional cable in duct or conduit space over existing cable routes.

(7) Applications for authority to modify existing facilities where the modification will involve no significant construction external to an existing structure.

(8) Applications for authority to construct an antenna structure which is to remain in place for a temporary period (as for the conduct of experimental operations or during the continuance of emergency conditions) and then be removed, provided there will be no lasting effects of environmental significance.

(9) Applications for authority to construct a temporary structure on an existing antenna site to maintain service pending repair of the permanent structure.

(10) Applications for authority to replace an existing antenna structure with a new structure on the same site having essentially the same height and design.

(11) Applications for authority to construct facilities to be utilized exclusively in rendering services to the United States Government, where the existence or purpose of such facilities is classified security information. (In such cases, it would appear that the environmental determination should be made by the Government agency for which the services are to be rendered under procedures compatible with the national security and on the basis of information which that agency alone may have.)

(b) The purpose of the preliminary environmental report is to require the applicant, and to permit the Commission, to ascertain whether the construction proposed would involve a significant environmental problem. If the applicant concludes that the proposed construction will have a significant effect on the quality of the human environment, he should file a detailed, rather than a preliminary, environmental report. The preliminary report shall describe the construction site and the construction proposed, including auxilliary construction such as access roads and power lines. It may be set out as a narrative statement. The following questions are illustrate of those which should be answered in the report:

(1) *Harmony with man-made uses.* How far is the proposed construction from the nearest structures not owned or utilized by the applicant? What is the character of these structures (e.g., residential, business, industrial)? How is the area zoned? Was it necessary for the applicant to obtain a zoning variance? State your conclusion as to whether the proposed construction is in harmony with or would disturb man-made uses of the surrounding area. If there are elements of disharmony or disturbance, state why they are not considered of environmental significance.

(2) *Harmony with natural uses.* Does the proposed construction intrude in any significant way upon wilderness areas, wild-life preserves, natural flyways for birds, or like areas? Would construction require the significant destruction of vegetation required as food or shelter by animal life native to the area? If there is some intrusion upon natural uses, state why it is not considered to be environmentally significant.

(3) *Harmony with environmentally valuable sites.* Is the proposed construction so situated as to detract in any significant respect from the value of any scenic, cultural, historic or recreational site? If there is some intrusion on such a site, state why it is not considered to be environmentally significant.

(4) *Substantial change in the character of land utilized.* Does the proposed construction effect any substantial change in the character of the land utilized (e.g., deforestration, water diversion, wetland fill, or other extensive change of surface features)? If there is some substantial change in the character of the land utilized, state the reasons for concluding that the change is not environmentally significant.

(5) *Comments and complaints.* What efforts (if any) have been made to elicit comment on the environmental effect of the proposed construction? Submit copies of any written comments or complaints received.

§ 1317 *Applicant's detailed environmental report.*

A detailed environmental report shall be filed if it is determined by the applicant or by the Commission that the proposed construction will have a significant effect on the quality of the human environment or if there is reason for substantial doubt as to the proper conclusion. The detailed report, like the preliminary report, shall describe the environmental impact of the proposed construction and shall, in addition, deal with such of the following matters as may be pertinent:

(a) *Any adverse environmental problems which cannot be avoided should the proposal be implemented.* (1) What steps have been taken or will be taken to reduce, minimize, or eliminate any adverse environmental impact? These could include reforestation, landscaping, architectural innovations, sewage treatment facilities or arrangements, fences to limit access to dangerous areas.

(2) Assuming such steps are taken, what significant environmental problems remain which cannot be avoided?

(3) Why can they not be avoided?

(b) *Alternatives to the proposed action.* (1) What alternatives have been considered which could reduce, minimize or eliminate any adverse environmental impact? These could include relocation of the construction site, location of an antenna or an existing structure rather than on a new tower, self-supporting rather than guyed antenna towers, and so forth. Where receiving equipment is subject to control by the applicant, consideration could also be given to use of higher capability receivers with a shorter transmitting antenna tower.

(2) What environmentally desirable alternatives exist that have not been adopted?

(3) Why have they not been adopted?

(c) *The cumulative long-term effect of the proposed construction, to the extent it differs from the immediate effect of the project considered in isolation.*

(d) Any irreversible and irretrievable commitment of resources which would be involved in the proposed construction. This provision relates to the depletion of limited natural resources, which is a factor we would not expect to be present in the construction of communications facilities, except possibly in limited respects

(see, e.g., § 1.1315(b)(2) and (4)). Nevertheless, the environmental report should deal with this factor, should it be present.

§ 1.1321 *Commission consideration of environmental effect.*

(a) The Commission will consider the environmental effect of proposed construction in all instances in which a preliminary or detailed environmental report is required.

(b) If the request is not accompanied by a detailed environmental report, and if it is clear from the preliminary environmental report that the proposed construction will not have a significant effect on the quality of the human environment, the request will thereafter be processed without further consideration of environmental factors.

(c) In reviewing the preliminary environmental report, the Commission may require the submission of additional information or may direct the applicant to request (additional) comment and report the results to the Commission. Processing of the application will be deferred pending receipt of such additional information.

(d) If upon reviewing the preliminary environmental report the Commission concludes that the proposed construction will have a significant effect on the quality of the human environment, or if there is substantial doubt as to the proper conclusion, the Commission will direct the applicant to submit a detailed environmental report and will defer processing the application pending receipt of such report.

(e) In reviewing a detailed environmental report, the Commission may direct the applicant to consider additional measures or alternatives which could reduce, minimize or eliminate an environmental problem and which were not considered in the report. The Commission may direct that technical studies be made or that expert opinion be obtained regarding the effect of the proposed construction and regarding the environmental, communications and cost effects of additional measures or alternatives which could reduce, minimize, or eliminate an environmental problem.

(f) If a detailed environmental report is submitted with the application or subsequently filed pursuant to Commission direction, the Commission will publish in the Federal Register a public notice containing the following information:

(1) The nature and location of the construction proposed.

(2) Whether there has been opposition to the application on the basis of environmental considerations.

(3) A brief statement regarding the nature of any environmental problem dealt with in the detailed environmental report or raised in any opposition to the application.

(4) A statement that the application and the environmental report and any oppositions are available for inspection at the Commission and in the local community or, if construction is not localized, at other appropriate locations.

(5) A statement that comments or petitions to deny the application on the basis of environmental considerations may be filed within 30 days after publication.

(g) Action on the application will be deferred for 30 days following publication of the notice in the Federal Register. Comments or petitions to deny the application on the basis of environmental considerations shall be filed within this 30 day period. If a person who comments or petitions to deny is specially qualified in any way to comment on environmental considerations, a statement of his qualifications shall be set out in the petition. Comments and petitions to deny shall be served on the applicant. The petition to deny shall contain specific allegations of fact sufficient to show that the petitioner is a party in interest and that grant of the application would be prima facie inconsistent with the public interest. Such allegations of fact shall, except for those of which official notice may be taken, be supported by affidavit of a person or persons with personal knowledge thereof.

(h) Provisions for public notice and petitions to deny on the basis of environmental considerations shall apply whenever a detailed environmental report is filed, regardless of whether the request would have been subject to notice and petition to deny procedures on other grounds. However, provision for notice and petition to deny on the basis of environmental considerations shall not open the application to attack on other grounds. Where a public notice is required for environmental and other reasons, a single notice may be published.

(i) Where public notice is published in the Federal Register, copies of the application, the detailed environmental report, and all related materials will be forwarded to the Council on Environmental Quality, to other Federal agencies having jurisdiction of special expertise with respect to the environmental impact of the proposed construction, and to appropriate State and local agencies, with a request for comment on the environmental impact of the construction proposed. The applicant may be required to file such number of additional copies of the application and related papers as are required for this purpose. Thirty (30) days will be allowed for comment. The identity and qualifications of the person(s) who prepared the comments shall be specified therein. A copy of agency comments shall be served on the applicant by the commenting agency.

(j) The applicant may respond to petitions to deny and agency comments within 21 days after the time for filing such petitions and comments has expired. The response shall be served by the applicant on persons who filed petitions to deny and on agencies which filed comments. The response shall contain specific allegations of fact or denials thereof, which shall, except for those of which official notice may be taken, be supported by affidavit of a person or persons with personal knowledge thereof.

(k) The application, the detailed environmental report, and all related papers, including agency comments, shall be routinely available for public inspection.

(l) The applicant shall maintain a copy of the application, the detailed environmental report and related papers in the local community and make them available for inspection upon request. If construction is not localized, these materials shall be made available for inspection at such location(s) as may be appropriate to provide reasonable access to persons affected by the proposed construction.

§ 1.1323 *Commission action following the submission of comment on environmental effect; detailed environmental statement.*

(a) Following completion of procedures designed to elicit information and comment regarding the environmental effect of the proposed construction, and upon consideration of all information submitted, the Commission will make a determination as to whether such construction will have a significant effect on the quality of the human environment.

(b) If it is determined that the construction will not have a significant effect on the environment, the application will thereafter be processed without further consideration of environmental factors.

(c) If it is determined that the construction will have a significant effect on the environment, the Commission will prepare a detailed environmental statement. The statement will indicate the nature, location, and environmental impact of the proposed construction and will deal with such of the following matters as may be pertinent:

(1) Measures which will or could be taken to reduce, minimize or eliminate any adverse environmental impact.

(2) Alternatives to the proposed construction which could reduce, minimize or eliminate any adverse environmental impact.

(3) The cumulative, long-term effect of the proposed construction, to the extent it differs from the immediate effect of the project considered in isolation.

(4) Any irreversible and irretrievable commitment of resources which would be involved in the proposed construction.

The detailed environmental report may be incorporated by the Commission into its detailed environmental statement. The statement, shall, in addition, however, take into consideration all matters of substance raised by persons or agencies objecting to the construction on the basis of environmental considerations and shall contain an independent statement of the Commission's conclusions.

(d) The detailed environmental statement will be associated with the application and will be routinely available for public inspection. Copies of the statement will be forwarded to the Council on Environmental Quality and to individuals who filed petitions to deny and agencies which filed comments. Action will not be taken less than 30 days after issuance of the detailed statement.

(e) If on review of the detailed environmental statement the Commission finds that there is no substantial and material question of fact relating to environmental considerations and that the public interest will be served by granting the application, it will grant the application.

(f) If on review of the detailed environmental statement it appears that there is a substantial and material question of fact relating to environmental considerations or that the Commission is unable, on the basis of environmental considerations, to determine that a grant of the requested authorization will serve the public interest, convenience and necessity, it will designate the application for hearing on an environmental issue.

(g) If on review of the detailed environmental statement the Commission finds that there is no substantial and material question of fact relating to environmental considerations but that a hearing is required for other reasons, it will designate the application for hearing on non-environmental issues only.

(h) Regardless of the action take, the Commission will issue a statement of the reasons for its action.

§ 1.1325 *Consideration of the detailed environmental statement during the hearing and decision-making process.*

(a) If a case is designated for hearing on an environmental issue, the detailed environmental statement will be attached to the designation order and will be considered in delineating the scope of the environmental issue.

(b) Copies of comments from Federal, State and local agencies will be associated with the record of the hearing proceeding, shall be admissible in evidence for the limited purpose of showing the views of those agencies, and may be used in cross-examining witnesses on the environmental issue.

(c) Agencies and individuals who comment on environmental effect may be invited to participate as parties to the proceeding and, if not named as parties, may petition to intervene. Agencies which comment may be asked by Commission counsel or others to furnish expert witnesses to testify on matters of environmental impact. Subpoenas for the appearance of such agency experts will be issued, if necessary, when their testimony is required to lay a foundation for the admission of agency comments in evidence to show the truth of facts and the validity of conclusions contained thereof.

(d) The burden of proceeding with the introduction of evidence on the environmental issue, as well as the burden of proof on that issue, shall be upon the applicant, except as otherwise provided in the designation order.

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PETITIONS: DELAY the DOCKET! REPEATER RESPONSIBILITY

4 October 1972

PETITION: To delay amendment of the Commission regulations (Docket 18803) for a period of one year to give repeater groups sufficient time to meet the drastic changes which the new regulations demand.

The October 17th deadline for amendment of the rules is wholly unrealistic since the new rules require substantial changes for most of the active repeater stations now in the amateur services.

It will take considerable time for the nearly one thousand repeater groups and clubs to understand the requirements of the new regulations, assess the changes that will be required to conform to them, raise the money necessary to buy the equipment or parts needed for the new control link functions, build and test the new circuits and links, and get everything working.

In addition to this there is the matter of developing the information needed for applying for the new repeater, control and link licenses, which could be formidable for people who are working in their leisure time without renumeration.

Unless the Commission delays the adoption of this amendment it would work a serious hardship on most of the repeater groups.

At a recent meeting of twenty-nine repeater groups in Waltham the vote was unanimous to request the Commission to delay adoption of the new regulations. The entire group felt that the difficulties and problems posed by the new regulations were so severe that the old regulations were preferable, even though this meant the loss of the 147 MHz segment to Technicians.

Wayne Green W2NDS/1

PETITION: To amend the regulations for amateur repeater stations to the effect that control operators are responsible for the technical operation of the repeater, not the content of emissions. The responsibility for content would fall entirely upon the originating operator.

The Commission regulations for controlling amateur repeater stations would seem to encompass two separate functions – the technical maintenance of the repeater and a censorship role over users of the repeater.

In view of the almost total ambiguity from the Supreme Court right on down to the lowest courts as to what can or cannot be broadcast or published, what is obscene or profane, etc., it is obvious that no amateur is properly equipped to undertake this function. The Commission provides no clear guidelines for amateurs embarking on this censorhsip role. Amateurs who watch Commission licensed television stations and listen to Commission licensed broadcast stations would be hard put to make any reasonable decision as to what is or is not profane or obscene.

Perhaps the control operator should follow the Supreme Court rulings and listen at length to transmissions made through the repeater to decide whether there is redeeming social merit in the matter.

The primary responsibility for emissions would seem to rest with the operator originating the emissions. A control operator cannot shut off a repeater quickly enough to prevent some profane transmissions. Let's assume that the word "fuck" is judged to be profane – or at least objectionable. It only takes a few milliseconds to send this word through a repeater. A diligent amateur with some psychological problems (and there are some) can break in with a quick "fuck" every few minutes and present an insoluable problem to the control operator. If he is really into the project he can automate with a tape recorder and clock so he won't have to wear himself out in the process. The short breaks make direction finding difficult. Just what is the responsibility of the control operator when faced with this sort of thing – and where does it end?

There seems little reason why one person with problems should be able to effectively shut down a repeater. The simple change in the regulations requested would solve this difficulty.

It is possible that amateurs might feel more secure in their role of censor, should the Commission decide that this should be continued, if they had an official Commission list of words or phrases that are considered profane or obscene. It would make it much easier as the control operators sat there on their long nightly vigils, monitoring each and every transmission going through the repeater if they had such a list. Such a list, if provided, will be published and circulated to repeater control operators.

The ability to force a repeater off the air with obscenities is a powerful weapon in the hands of an amateur with psychological problems. Until the Commission adds a psychiatric exam to the amateur license exam there will inevitably be a few people with serious mental problems who manage to get a ham license. The ability to learn code is no measure of sanity – to the contrary, according to some psychological circles.

If repeaters were able to stay on the air it would not be difficult for repeater groups to locate profanity problems. The Commission has recently given special permission for repeaters to stay on during jamming problems to help in locating the offending parties. If repeater control operators were responsible for the technical operation of the repeater and not for censoring it, these annoyances could be dealt with forthwith.

The Commission would consider that the listeners to a repeater are generally few in number, particularly in comparison to a broadcast or television station, and that the listeners are generally reasonable mature (in age) persons. Thus there is a small liklihood that profanity would cause any serious and irreperable harm. Since the Presidential Commission report on obscenity was unable to discover any damaging effect from even the vilest pornography, the probability that profanity on amateur radio would have a lasting effect is small.

It is therefore requested that the Commission amend the amateur regulations to place the responsibility for emissions on the operator originating them and not on the control operator of a repeater which might repeat them.

Wayne Green W2NSD/1

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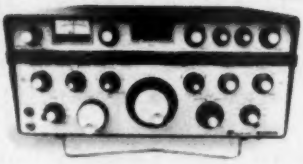

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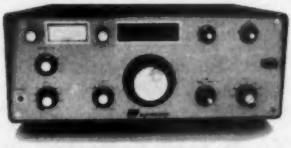
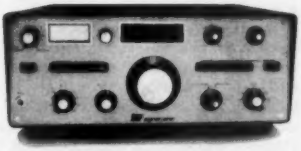


There's a new CT-1500 transmitter, the matching transmitter for use with the CR-1200 and CR-1500 receivers. It incorporates all modes of operation and includes the famous Signal/One RF envelope clipping, broadband tuning, full-automatic CW keying, and many other features.



We're also introducing a new transceiver, the CX-10, which contains several CX7-A features. In addition, it can be used with either our new AC or DC power supplies, an external VFO, and other accessories.

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Loring C. White W1ODI
26 Boswell Road
Reading MA 01867

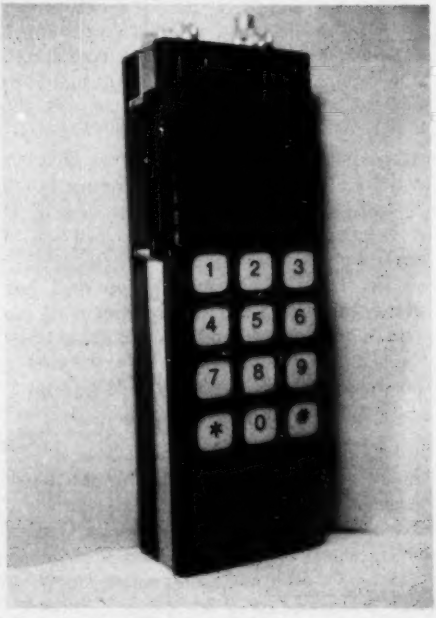
HANDIE-TALKIE TOUCH TONE

Make phone calls through the local repeater while walking down the street with this modified HT-220.

For those of you who might like to make phone calls from your back yard or who would like to make up a "phone in the shoe" system a la the "Get Smart" TV program, here is a way to do it!

If you happen to find a Motorola HT-220 2 meter handie talkie (which, incidentally, is smaller than my shoe size) in the shack junkbox, you are a long way to realizing your own wireless touch tone system. You will need the following additional items:

1. Touch pad Chomerics #EF-20071, $7.95
2. Tone generator – hybrid chip – Microsystems International Canada #ME-8900 CA., $25.00
3. 5 μF capacitor
4. 700Ω resistor
5. 40 KΩ resistor
6. 10,000Ω micro potentiometer
7. Plexiglas shim plate 3 x 2.25 x 1/8 in.



Looking at the photo you will see that the "pad" is mounted just below the speaker grill. It is necessary to insert the plexiglas shim plate between the HT-220 case and the pad in order to take up space from the connecting pins on the back of the pad. So that the pad and spacer will lie flat against the front cover, it will be necessary to file the rounded surface of the cover flat, just under the pad. The file work is about the toughest part of the whole job, but is very important to prevent warping of the thin pad.

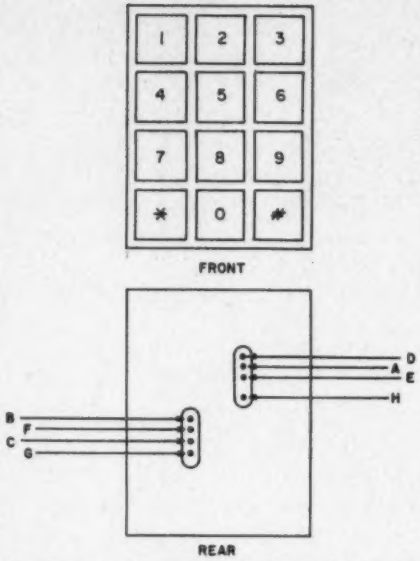


Fig. 1. Front and rear view of the touch pad and its connections.

It will be necessary to drill two small slots through the HT-220 front to accommodate the eight miniature pins on the back of the pad. Remove and disconnect the HT-220 front cover and carefully locate the two pin areas free of the internal battery connecting strips. The pad may be conveniently attached to the cover using contact cement. It may be advisable to hook up the pad first to determine if everything is operating okay.

The hybrid chip may be counted just above the "PL Tone" compartment in the "thick case" model and the additional components cemented to the chip case, between the pins.

Keeping the wires as short as possible, interconnect the pad and chip as follows:

Chip Pin	Pad Pin
4	A
5	B
6	C
8	H
9	G
10	F
11	E
12	D
13	Neg. 15V battery
16	Through 700Ω to pos. 15V battery
1,2,3,14,15	N.C.

I found that some rf problems disappeared after bypassing a few of the chip contacts with .001 μF ceramic capacitors to the negative battery terminal.

The degree of bypassing required will be determined by the application, antenna matching, etc.

Be sure to take the positive battery connection from a point on the HT-220 transmitter board so that the pad will be "on" only during transmitting periods.

The system is quite compatible with the Bell Tone System even though the output tones are considered to be pure sine wave as compared to the tones coming from the regular Western Electric pads.

Adjustment of the tone output level is most conveniently done by observing the transmitter output on an oscilloscope.

Adjust the 10,000Ω potentiometer for proper FM deviation level in accordance with the autopatch requirements of your favorite repeater.

We have made several phone calls with the handie-talkie touch tone system over the Weston repeater, WA1KHB, and fired up the "Sanford link" through K1MNS from a location 15 miles north of Boston, Massachusetts.

A completely assembled 12-button pad with tone generator and all parts is available for $30.80 from Tom McKeever W1WJR, 28 Leigh Road, Norwell MA 02061. He also has quantities of 16-button pads for $35.12. Please add $1.20 for postage and handling.

. . .W1ODI

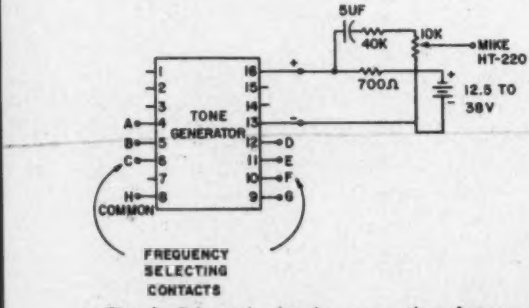
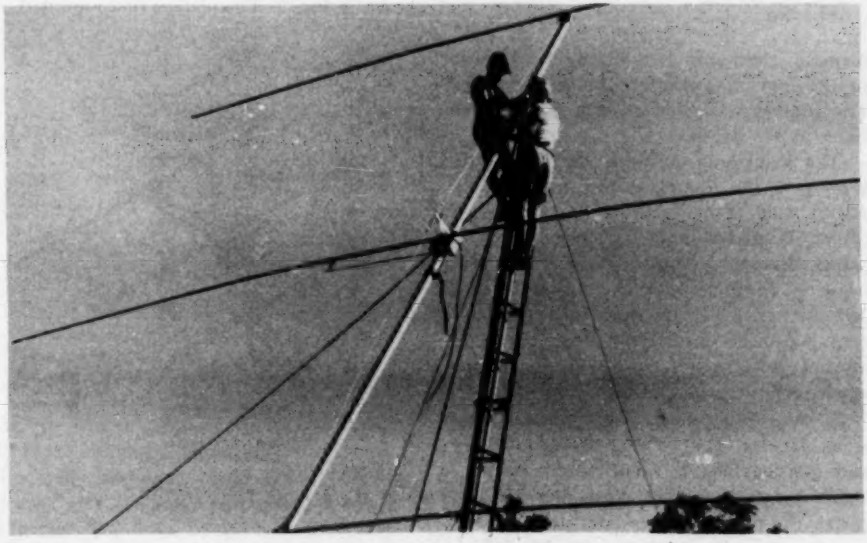


Fig. 2. Schematic showing connections between touch pad and tone generator.

HOW TO WIN IN THE PILEUPS

Chet Latawiec VE3CFK
569 Carlton Street
St. Catharines, Ontario



There is an XT2 sitting on the band and everybody you can think of is calling him, trying to beat the other fellow out. So you get in and try your luck with your kilowatt and your dipole. If you're lucky, you might work him – that is, if you live a couple of miles away from the chap. If not, there is no conceivable way you can work the fellow within the next couple of hours.

So get away from the ordinary and build yourself a three-element, wide-spaced beam and be the first to work that rare DX. I guarantee that with this type of antenna you can beat out any three-element triband beam and even some of the short-boom four-element beams.

This three-element, widespaced beam is plenty sturdy; it is of all-aluminum construction and so far has withstood winds up to 80 mph and a few Canadian ice storms.

If you intend to build this beam, *do not* alter any of the physical dimensions, as this will decrease the efficiency of the antenna. The frequency of the array was set in the middle of the band to allow its use on the CW and phone portions of 20m.

The elements are constructed of thin-wall aluminum tubing, of the diameter and length stated in Table I.

Each element is constructed of seven pieces. The center portion is 1 in. inside-

The view of the antenna element and its mounting.

diameter aluminum conduit to give strength to the remaining portions of the elements. The conduit is slotted at each end on both sides for about 3 in.

The remaining portions are fitted together to the values shown in Table II. About 4 in. from each individual piece of tubing is placed a self-tapping screw to insure that the elements do not move or rattle. At the end of each element is placed a drip hole about 1 in. from the end and a cork is press-fit in the end of the tubing to prevent the elements from whistling in the wind.

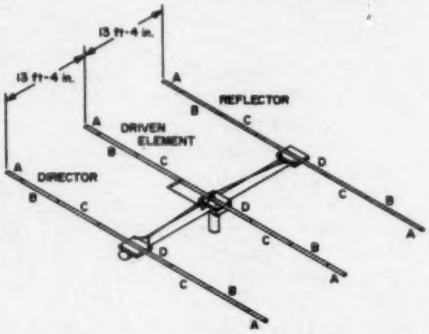
All three elements are constructed in the same manner, the only difference being their physical lengths. To obtain the proper length on each side of the center of the boom, the thin-wall aluminum portions of the elements are adjusted in or out of the aluminum conduit. Once the proper distance has been attained, drill a hole about 8 in. from the edge of the conduit and drop a self-tapping screw in, and also place a hose clamp about 1 in. from the end of the conduit.

Just a small note here on cutting the thin-wall aluminum. Most of the tubing comes in 12 ft lengths, so on the antenna portion cut the tubing in half and to obtain the proper lengths for the director and reflector for their overlap cut the tubing 6 in. off center.

The boom is a 17 ft 4 in. piece of 3 in. aluminum irrigation tubing. It is the most expensive single portion of the antenna, but is well worth the money spent, from at least the standpoints of the strength it gives and its light weight.

At each end of the boom there is a circular block of wood, the diameter of the pipe, which is fitted in the end of the pipe and then nailed. This precaution is necessary unless you are a bird lover.

The main feature of this antenna is the method used to mount the elements to the boom and keep them there. Aluminum plates (0.25 in. thick) are used in this deal. The plate is held to the boom by two 3 in. muffler clamps. The plate in turn holds the element with two smaller muffler clamps as shown in Fig. 2. The plate is first mounted



ELEMENT LENGTHS

REFLECTOR 35 ft-5 in.
DRIVEN EL. 33 ft-5 in.
DIRECTOR 31 ft-5 in.

ALL MOUNTING PLATES ARE 8 in. x 8 in. SQUARE

ELEMENT SECTION	ELEMENT			TUBING DIAMETER
	DIRECTOR	DRIVEN EL.	REFLECTOR	
A	2 ft	2 ft	2 ft	3/4 in. O.D.
B	5-1/2 ft	6 ft	6-1/2 ft	7/8 in. O.D.
C	5-1/2 ft	6 ft	6-1/2 ft	1 in. O.D.
D	10 ft AL. CON.	10 ft AL. CON.	10 ft AL. CON.	1 in. I.D.

TABLE I – THIN WALL LENGTHS

ELEMENT SECTION	DIRECTOR	DRIVEN EL.	REFLECTOR
A	1 ft-3 in.	1 ft-3 in.	1 ft-3 in.
B	4 ft-9 in.	5 ft-3 in.	5 ft-9 in.
C	4 ft-9 in.	5 ft-3 in.	5 ft-9 in.
D	10 ft	10 ft	10 ft

TABLE II

THE VALUES GIVEN ARE FROM THE EDGE OF ONE PIECE TO THE EDGE OF THE OTHER.

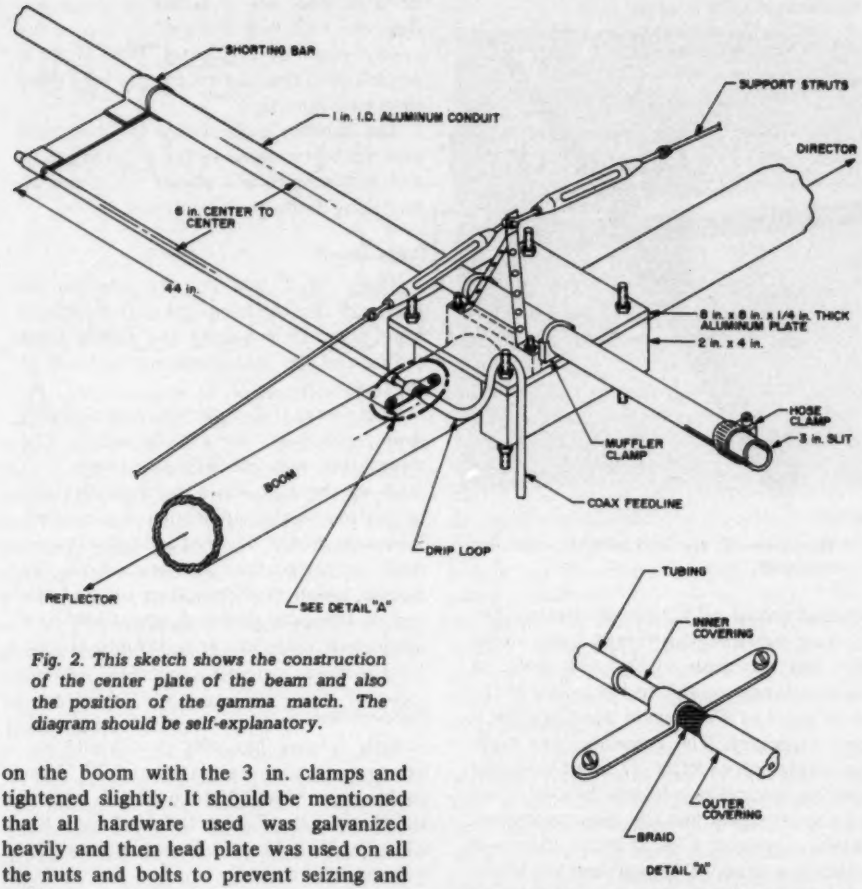


Fig. 2. This sketch shows the construction of the center plate of the beam and also the position of the gamma match. The diagram should be self-explanatory.

on the boom with the 3 in. clamps and tightened slightly. It should be mentioned that all hardware used was galvanized heavily and then lead plate was used on all the nuts and bolts to prevent seizing and rusting.

The aluminum conduit portion of the elements is mounted and tightened on each plate. There are two pieces of grappling iron, about 6 in. long, which are placed on each side of the boom, one each under the nuts which are the furthest away from the ends of the boom. Make sure that the distance from the center of one parasitic element to the other is 26 ft 8 in.

The center plate is a two-fold job. Two pieces of 2 x 4 are cut to length of the plate and long bolts about 7 in. are placed through the plate and boards and slightly tightened.

This plate is mounted to the boom as the other two were, using muffler clamps again. Then the conduit is mounted and clamped in its place. By sighting at the end of the boom, look at the three pieces of conduit and make sure that all three are parallel to each other, then tighten all the muffler clamps.

Now the remaining portions of the elements are placed in their respective places and finally the hose clamps are installed and tightened. When you do this make sure that the drain holes are on the bottom facing the ground.

Matching

On this particular antenna, a gamma match was tried and when adjusted properly, proved to be a very wise choice because the swr was flat across the band and did not exceed 1.2:1. It was con-

The view of the end element and its mounting.

structed out of a TV antenna element. The shorting bar was constructed from aluminum and was made so that the center of the aluminum conduit to the center of the 48 in. piece of TV element was 6 in. This is very important. The capacitor was made out of a length of RG-8, 41 in. of the outer covering was taken off and then 40 in. of the copper shield had the same treatment. On the remaining 1 in. of braid, there was soldered a brass or copper bracket which will later be used to mount it to the beam. The remaining portion of the stripped end of the coax was placed inside of the gamma tubing.

The bracket must be mounted onto the boom and it must keep the 6 in. from center to center constant.

The bracket is held in place by two self-tapping screws placed on either side of the hump in the bracket. At the other end of the coax a coaxial connector was placed to provide easy connection to the feedline. The inside of the shorting bar is 44 in. from the center of the boom.

Installation

The beam is installed on the mast by means of another plate. This plate is made of ¼ in. steel and is drilled to accommodate the four long bolts which are on the center plate of the beam. This plate is welded onto the mast to provide for a good slip-free connection.

The antenna is lifted onto the steel plate and the bolts placed in the hole. The nuts and lockwashers are placed on it and all mounting hardware is tightened.

Adjustment

There need not be any adjustments necessary to the elements if precautions were taken in acquiring the proper sized tubing and the measurements followed to the inch.

There may be, however, some adjustment needed on the gamma match. The values that were given in the above were used on three previous antennas identical to this one and no adjustment was needed. However, should the need arise that it does need attention, then the bracket on the gamma match must be taken off and the end of the coax trimmed, about half to a whole inch until the swr is down to at least 1.5:1.

Performance

With a beam like this you should not have any trouble working that XT2. You could even work 200 countries with a 100W, thus eliminating the need for a big kilowatt. This beam can outperform any antenna in its class.

Specifications

Gain	8.5 dB over a dipole
FBR	25–30 dB
Side Att	50 dB
Boom	27 ft 4 in. x 3 in.
Turning Radius	22.5 ft
Weight	45 lb
Cost	$80

Acknowledgements

Thanks goes to Howard Cowling (VE3WT), whose plans and ideas were presented in this article and also for the help he gave me in preparing and presenting it. Thanks also goes to Berny Goldchuck (VE3FYG), who took the pictures.

...VE3CFK

Ed Gribi WB5IZF/YB8AAP
Holland Park D-1
Singapore 10

IN THE HALLS OF THE GIANT... THE YAESU ESTABLISHMENT

A phenomenon of the last five years in the amateur market has been the emergency of Japanese manufactured rigs of high quality, innovative design, and highly competitive pricing. The leader of this pack has been the Yaesu Musen Co., Ltd., which probably sells more HF SSB transceivers than all the rest of the world manufacturers put together. Certainly then a visit to the lair of this giant would be a highlight for a ham visiting Japan. This is a record of my too brief visit with some tips for those of you who have the opportunity to pass through Tokyo in the future.

After concluding my busines in Tokyo, we had a free afternoon before plane time. A call indicated the Yaesu plant, somewhere out in the wilds of south Tokyo, would be happy to see us. Another phone call to the plant by a most helpful lady at our hotel information desk elicited the information that the plant was about a 40-minute taxi ride, and generally in the direction of the airport, but finding the place was a little difficult even for Tokyo. For five solid minutes she took down instructions in Japanese characters and then copied them neatly for the taxi driver – a must for even the simplest jaunt in this world's largest metropolis.

We piled into a taxi selected for us by the doorman, and the driver placed the precious sheet of instructions for quick reference. We shot off on one of the expressways, ran it to its end, then continued for miles on surface streets, finally narrowing down into some lanes. The highlight of this little journey for me was the many tantalizing glimpses into the gardens of private homes, each different but immaculate in design and appearance in the Japanese fashion. Thirty-five minutes or so brought us into the area where the driver started looking at me questioningly as I shrugged my shoulders. A couple of circles and obviously conflicting directions from people on the street suggested we were not making headway. At a phone booth, I put the driver on the phone to the plant for further orientation. Soon we had a 3 element yagi in sight and after one more circle we arrived at an unassuming three-story building.

Mr. Shigeru Takagi, KH3NUD, Sales Manager, met us and said this was really not now a manufacturing plant but rather the final inspection facility. One factory is west of Tokyo and the main manufacturing facility is north of Tokyo, in Fukushima. Three assembly lines are in operation at that plant and a new plant is under construction. Shigeru told me that there were forty FT-101's being turned out every day and almost forty of the FT-401/560-570 series. Add to this the several linears, the FT-200's (very popular in Japan), and the growing two meter line – Yaesu must have the lion's share of the amateur market. Their own estimate, admittedly not exact, is 80% outside the U.S. and perhaps 20–25% in the U.S.

Time was short, so up the stairs we went to meet Kim, JA1KRZ, in charge of the inspection facility. In a room about 40 x 100 feet about 25 technicians worked, each at an individual well-equiped test bench. Along one wall, literally stacked like hot

Just look at all those transceivers getting a final checkout before packaging. Recognize yours? (Photo courtesy YAESU)

cakes (which I guess they are selling like), were rows of the FT-2B and FT-2 Auto 2 meter transceivers. Kim showed us how the auto-scan feature worked on the FT-2. It was fascinating to watch the blinking red lights scan for an active channel. It was surprising how much 2 meter action existed, particularly when I learned that this was all direct. Repeaters are not yet legal in Japan, but the VHF boys are hoping this will be changed. That should be a boom to watch – can you imagine a country with a growing amateur population nearly that of the U.S., complete with a large, enthusiastic VHF contingent, suddenly being allowed to establish repeaters? The mind boggles.

The 2 meter gear intrigued us but it was equally impressive to see all the HF gear being given final testing and alignment. I noticed, by the way, that most of the test benches included Yaesu's own frequency counter. Shigeru told us that there were at least 100 hams employed by Yaesu. Yaesu must be the largest single employer of radio amateurs in the world.

All too soon lights were starting to go out and people were starting to head for home Time for us to bid our "Sayonara" and depart. But, for the rest of you , here are some tips if you should have an opportunity to go to Japan. I might add many of the things I did *not* do, myself. If you know your plans ahead of time, by all means write ahead and let them know your itinerary and interests. Letters will reach Yaesu Musen Co., Ltd., at Central Post Office Box 1500, Tokyo. I would imagine that a letter to the JARL, Box 377, would produce some interesting results. Yaesu's main office is at 3, 3-Chome, Yaesu, Chuoh-Ku, Tokyo, Phones 271-7711 to 7716. The factory we visited is at 2-15, 1 Chome, Kugahara, Ota-Ku, Tokyo, Phones 753-6141 to 6145.

Another place worth a visit in Tokyo is the Akihabara district of Tokyo where hundreds of eleectronics supply stores are scattered over 5 or 6 square blocks. Four or five of these stores deal specifically in ham gear. But, regardless of where you go in Tokyo, the rule is to have the hotel write the address and instructions in Japanese and have the doorman make sure the taxi driver understands them.

In any event, you'll find that the innate politeness and hospitality of the Japanese will make your explorations delightful experiences. Sayonara.

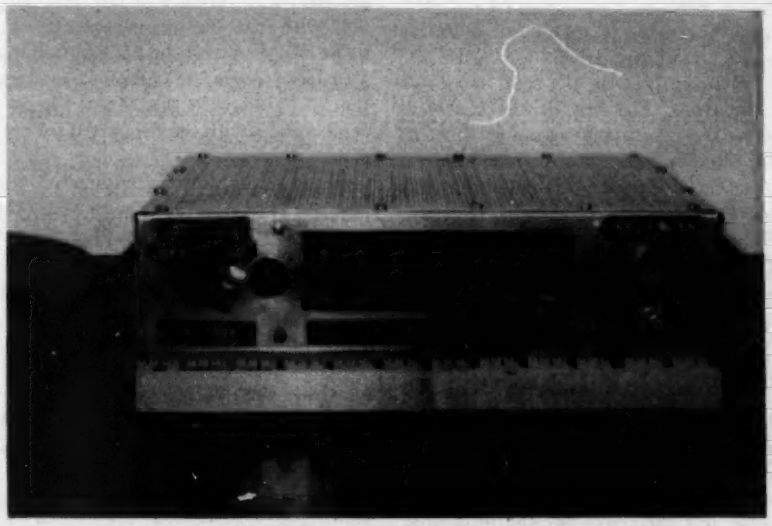
...WB6IZF

Tom Johnson KL7GGB/4
3001 Roxbury Road
Birmingham, AL 35209

ANOTHER INTEGRATED CIRCUIT FREQUENCY COUNTER

This counter was constructed as a personal project to help me better understand the workings of integrated circuits and their operation. That's why I used RTLs together with TTLs. I also had them on hand so it was cheaper than buying new ones. All of the circuits used are standard with no exotic tuning or adjustments.

The only test equipment required is a VOM to check voltages and a scope to troubleshoot possible bad connections. To set the time base generator on frequency I



The 50 MHz frequency counter. Notice how the author included a metric rule in the photograph to indicate the unit's width of 30.48 cm.

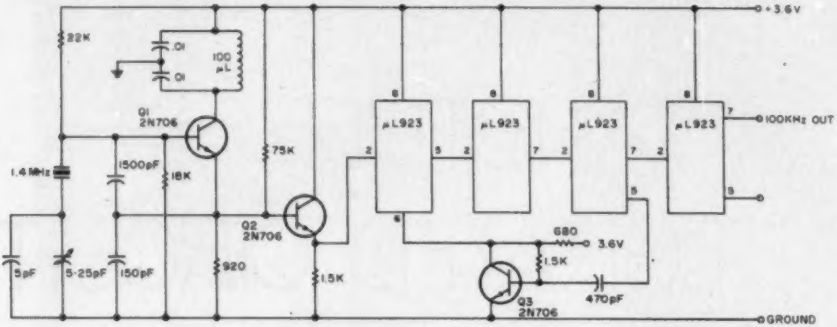


Fig. 1. Time base generator.

recommend comparison with a commercial counter or comparison with WWV using a scope to get as close as possible to the exact frequency. The common practice of zero beating by ear is just not accurate enough. This is especially true if you want the counter to have the best possible accuracy that this design will give. I calibrated a ten MHz crystal to WWV, then adjusted my counter to read 10.000.00+. That was the best method available with my limited resources.

Construction Ideas

The arrangement of the decade counting units (DCU) is straight in line with the SN74196 being first on the right as viewed from the front. The rest of the ICs were placed so as to keep the wiring as short as possible to minimize interference between sections. The main part of the counter was constructed on a 4 x 6" vector board with .1" center spaced holes which match the spacing of the ICs. No sockets were used although all ICs are removable. This was accomplished by using integrated circuit terminals. These terminals come in strips of 56 each. This is a convenient size as the whole strip can be inserted in the holes, wired and then the top of the strip is broken off giving the equivalent of sockets with less cost and effort. In my counter I use seven display tubes which fit well on the board and came out just right for the integrated circuit terminals. I use AKZ type tubes and sockets, they also fit the .1" spacing on the vector board. An etched circuit board would improve the looks, but that would not allow much flexibility in the development of the counter.

Input Amplifier

In the construction of the input amplifier I tried several types of integrated circuits before settling on the SN72733. Four 2N2369's were tried first and found to be unsatisfactory. The RCA CA3018 was then tried and found to be an excellent input when used with a 74H10 input gate, it will go up to 32 MHz with no problem. The SN72733 from Texas Instruments will work up to 50 MHz with the SN74S10 input gate. You have to use the combinations together, the SN72733 with the 74S10 for 50 MHz, the CA3018 with the SN74H10 for up to 32 MHz.

If you want lower frequency operation you can use the CA3018 with a SN7410 and by this route be able to use a SN7490 for

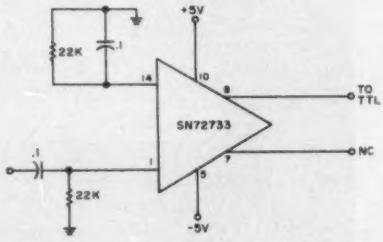


Fig. 2. Input amplifier circuit. Pins 3, 4, 11, 12, are open. Pins 2, 6, 9, 13 NC.

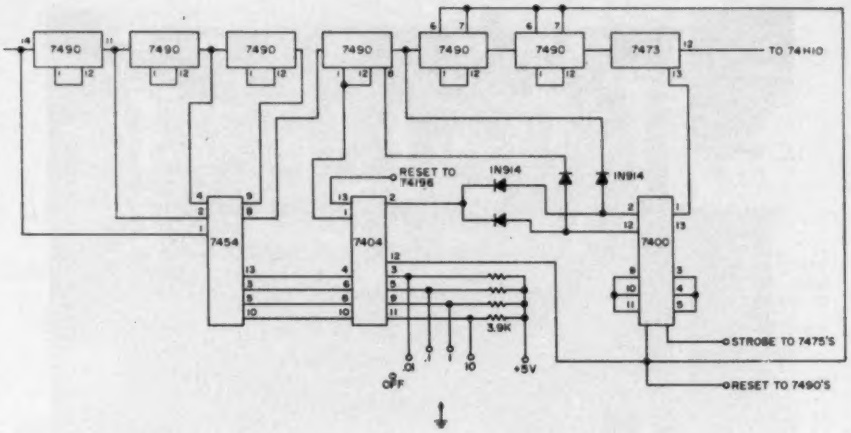


Fig. 3. Timing circuit.

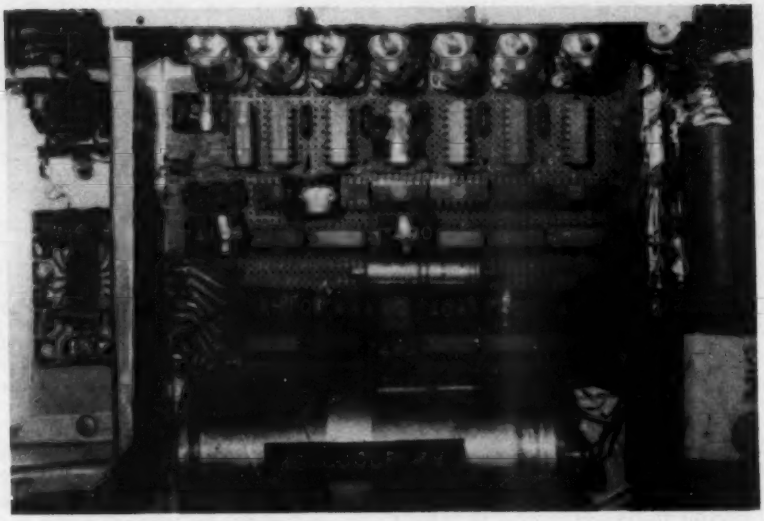
the first DCU. This combination would be able to count to approximately 20 MHz. I wanted to go all out and count as high as possible, so I continued until I could get at least 50 MHz. This is the only section of the counter where different designs were tried. The rest of the counter was designed and constructed with very few changes being made. From the input gate the signal is fed into the first DCU. All of the DCU's are alike except the first one which uses a SN74196, SN7475 and SN7441 which gives the first digit. The rest of the DCU's are SN7490, SN7475 and SN7441. The SN74196 is used in the first DCU because it has a higher toggle rate (50 MHz) than the SN7490 which will only go to 20 MHz maximum. The SN74196 has to be reset through an inverter because it needs a negative going pulse to reset whereas the SN7490 needs a positive going pulse.

The input gate is opened and closed by the Q output from the JK flip-flop SN7473. The $\overline{Q}$ output is connected to the four wide two-input *nand* gate SN7400 together with pulses from decade scaler number four to generate the strobe and reset. The diodes are used to decouple the set up pulses passing current in one direction only. The SN7400 is blocked from producing the strobe and reset except when the gate is closed by the $\overline{Q}$ output from the JK flip-flop. When the strobe is generated the count is transferred to the read out, then the reset is generated resetting the DCU's and scalers five and six to be ready for the next sequence in counting. This is a good scheme and gives a good ratio of read out time to count time.

Time Base Oscillator

The time base oscillator uses a 1.4 MHz crystal in a circuit using a 2N706. The padder in series with the crystal allows calibration to the exact frequency. The buffer is also a 2N706 that serves to drive the first μL 923 in the divide by seven circuit. Pin 5 of the third μL 923 is connected to another 2N706 in a half monostable circuit resetting the first μL 923 forcing a divide by seven. The last μL 923 divides by two giving 100 kHz output. This can be modified to fit any crystal as long as

Top view of the counter. Note the shielded compartment that separates the input circuitry from the rest of the unit.



Close up of the main circuit board showing the IC layout and Nixie tube mounting.

it can be divided by a whole number. The whole divider chain can be eliminated if you have a 100 kHz crystal. The 100 kHz from the RTLs is run through one section of the SN74H10 to improve the wave shape, that gate was left over from the input IC, so no parts were added. From the SN74H10 the 100 kHz is fed into the first of six decade scalers SN7490. Connected to the first three decade scalers is a four wide two input and-or-invert gate SN7454 together with four sections of hex inverter SN7407 making it possible to select one of four frequencies: 100 kHz, 10 kHz, 1 kHz and 100 Hz. These four frequencies, after going through the last three decade scalers, will give integration times of 0.01, 0.1, 1.0 and 10 seconds. The 0.01 second integration time has no real value in this design and need not be wired. However, if you use less than seven read outs, you will need it to read tens of MHz, it is also useful in checking and trouble-shooting.

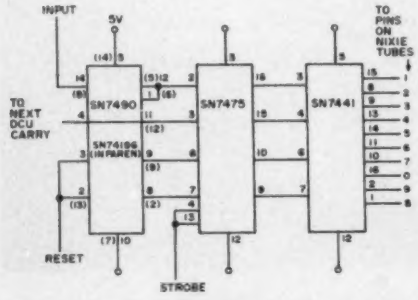


Fig. 4. The SN74196 requires an inverter on the reset. Pin numbers in bracket are for the SN74196. Pins 1, 3, 4, 10, 11 are open. Pin 7 Gnd, 14 +5V.

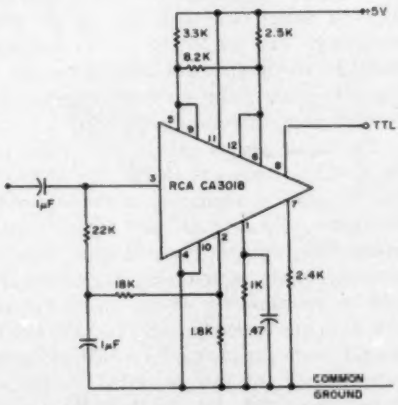


Fig. 5. Input amplifier for low level signals, 20 μV to .4 mV 3 db 800 Hz to 32 MHz.

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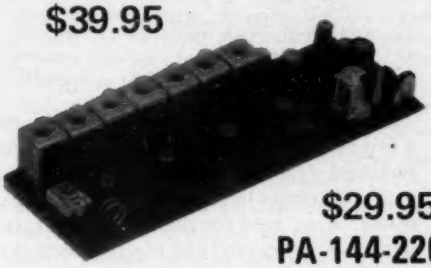

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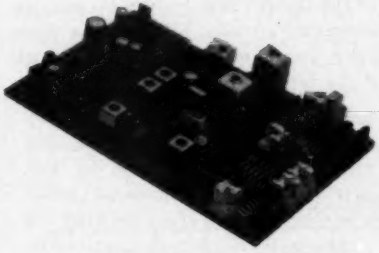

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Power Supply

The power supply uses a transformer rated at 500 Vct 50 mA and 6.3V 1.2A. Using a full wave rectifier on the 500 volts and 40 μF 450 volt capacitor gives approximately 300 volts dc under load. Three 27,000Ω two watt resistors in parallel drops the voltage down to the zener diode rated at 180 volts 10 watts. In series with each Nixie tube, there is a 22,000Ω half watt five percent resistor. The recommended voltage for the Nixie tube is 140 volts at approximately 2½ mA. This arrangement can be changed to fit what you have on hand by changing the series resistor to a value that will assure that no more than 140 volts are on the Nixies. The low voltage supply is a full wave bridge rectifier with 40,000 μF filter capacitor which gives about 8 volts. This is regulated by an IC, LM-390-K, that has a rated output of 5 volts at 1 ampere. The counter draws a little over half of that and runs cold. This regulator is cheaper than building one from scratch and is really better than the ones I have been able to make. The power supply is built right in the 12 x 8 x 3" chassis adhering only to an arrangement that saved as much space as possible. Not shown on the schematic is a minus five volt power supply for the SN72733 which is necessary if you decide to use this system. I managed to crowd in a small filament transformer with a half wave rectifier, 100 μF capacitor and a five volt zener diode. The SN72733 draws less than 30 mA, so not much is required. If you use the CA3018 this is not necessary. If you want to measure frequencies less than 10 MHz only, you could build a transistor amplifier using almost any fast switching type. In that case three or four read outs would be satisfactory. Then there would be no need for the different integration times so the SN7454 together with the switch could be left out. If you really want to cut it down you could use the power line frequency for the time base dividing by six to get .1 second integration, throw in a SN7490 to get one second. I see no reason why this scheme would not work although I haven't tried it myself.

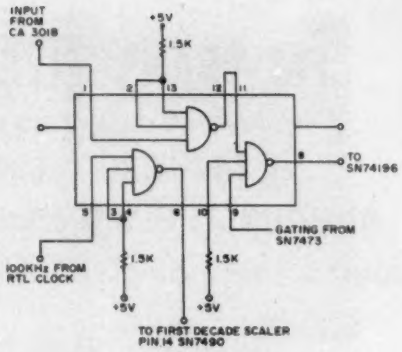


Fig. 6. Input gate using a SN 74H10

Trouble Shooting

Trouble shooting of integrated circuits requires a lot of pre-planning. Following are some of the things I have learned by working with integrated circuits. First, with a piece of hookup wire, jump pin five of the last μL 923 to the input. You should get 100 kHz

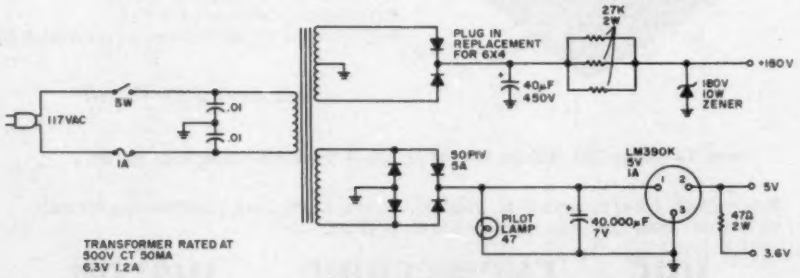
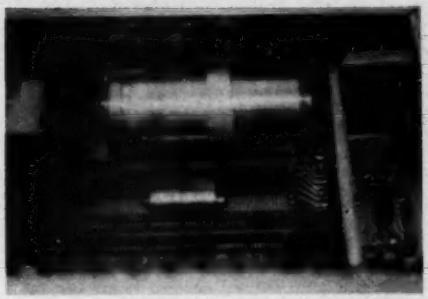


Fig. 7. Schematic of the regulated power supply.



Rear of the counter showing the time base oscillator circuit board and the three 27K power supply resistors mounted behind the filter capacitor.

on all ranges. Do not confuse this as an indication of the accuracy of the counter but as an indication that all systems are working. With a scope on pin 8 of the SN7454 you should get 100 kHz with the switch in the .01 second position, 10 kHz in the .1 second position, 1000 Hz in the one second position and 100 Hz in the ten second position. To check the rest of the decade scalers, put the switch in the .01 second position and follow the signal through the SN7490's by checking the pin 11 of each one, scaling down by a factor of ten for each IC. Finally, on pin 12 of the SN7473, check for the gate opening and closing, and on pin 13, for the timing pulses to the SN7400. Set the switch to the ten second position and measure the gate opening and closing with a VOM. The up's and down's occur pretty fast but it will show on the VOM. Pins 8, 1 and 12 of decade scaler 4 should be nice square waves with the frequency measured depending on the switch position. Pins 1 and 2 of the SN7404, pins 2 and 12 of SN7400 should all be square waves, however, the strobe and reset pulses are hard to lock on even with a triggered scope due to long down to up time.

Using your VOM, momentarily jump pins 3, 4, and 5 of SN7400 to ground and read a high on the reset line. Do the same thing on pins 9, 10, and 11; measure a high on the strobe line. Do not forget the reset on the SN74196 is inverted by one section of the hex inverter. An indication that all is not right is that one of the read outs has a preference for one digit. This can be caused by a bad connection from the SN7490 to the SN7475 or from the SN7475 to the SN7441. A bad connection from the SN7441 to the Nixie tube will show up as no digit on some count and a short will show one digit all the time. Trouble in the strobe line will cause it not to transfer or will flutter during counting. Trouble in the reset line can be detected by a continuous digit on the read out after the input has been removed and sufficient time has passed to reset. Be certain the connections between the SN7490, SN7475 and the SN7441 are correctly wired. An error in this department will cause the SN7441 to decode wrong. This could show up the same as a bad connection; that is, with no input and after the reset there would be some number on the read out. Depending on the cross and how it was decoded would determine what number would be on the read out.

The best bet is to be certain they are correctly wired the first time. If you think I was wrong the first time, you're right.

With a grid dip oscillator couple some rf into the counter using about twenty turns of hook up wire around the GDO coil. Starting at the low end of the dial, 1.6 MHz on mine, slowly increase the frequency until you get up as high as you can, adjusting the wire positioned on the coil to get the best coupling to the counter. Don't be discouraged by dead spots or a frequency difference between the GDO and the counter. The hook up wire will load the GDO down and make the dial read high. Using a tube type Millen GDO I had no trouble getting the counter to work to 50 MHz, after that I had a hard time getting in enough rf to count. I believe this system design would go up much higher in frequency, perhaps up to two meters.

...KL7GGB/4

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Digital Electronics for Scientists, Malstadt and Enke, The Heath Company.

RTL Cook Book, Donald E. Lancaster, Howard W. Sams Co.

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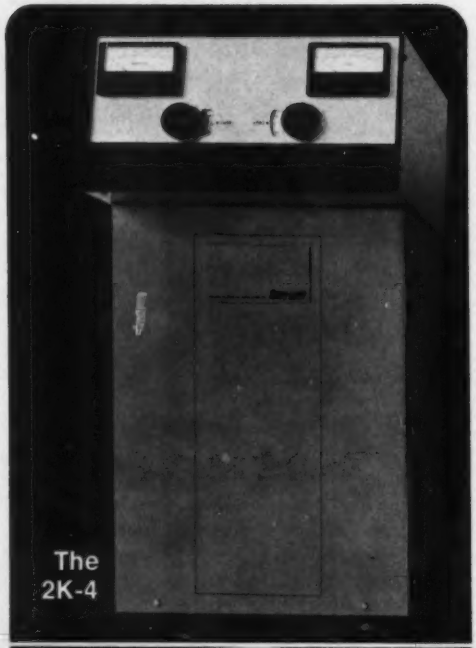

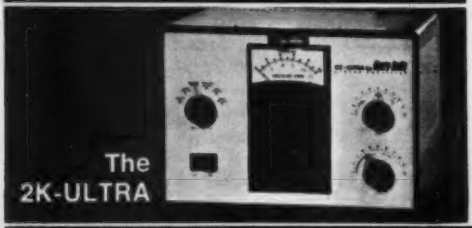

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The advantages of speech processing for single sideband voice transmitters have been pointed out from time to time for a number of years. Speech compression produces some gain in voice power and may reduce peaks substantially if the attack time is fast enough. It offers another advantage of keeping the speaker's voice level constant as his speech power varies or as he moves his head. Clipping increases the relative power of intelligible speech by cutting off voice peaks. Since truncated waveforms produce high-order harmonics whose presence is enhanced in the single sideband mode as compared to AM, it is especially important that clipping be followed by bandwidth-restrictive filters.

Figure 1 is presented to demonstrate the advantages of peak reduction. Figure 1a is a simplified presentation of a portion of a typical voltage waveform of a syllable, as displayed on an oscilloscope with an internally triggered sweep. The spikes contribute almost no intelligence, yet an rf amplifier must not be driven beyond where the spikes flat-top; i.e., saturate the final stage. Most of the intelligence is in the small wiggles. By clipping the spikes and amplifying the useful portions of the waveform to drive the final up to flat-topping, the net intelligible voice power is increased.

The rf envelope of unprocessed speech may look something like Fig. 1b. The width of the spikes increases in a manner suggesting a train of pulses passing through a circuit of restricted bandwidth. The small wiggles are a mixture of intelligible speech and higher harmonics of the repetition rate of the spikes. When peaks are reduced by processing, the waves representing intelligible speech produce rf envelopes which are not exceeded in height by any spikes. In fact, it is difficult to trigger the oscilloscope internally under these conditions because there is no longer a predominant group of spikes.

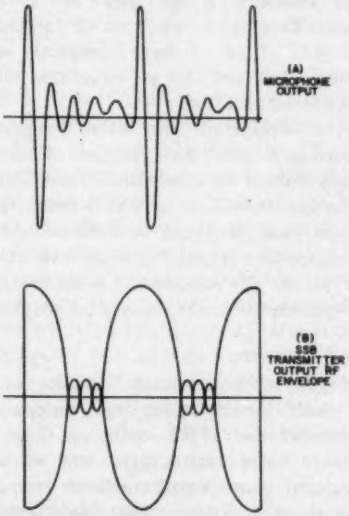

Fig. 1. Unprocessed speech: simplified picture of part of a spoken syllable seen on a triggered sweep.

The speech processor to be described

resulted from an attempt to reproduce the solid state processor of WB2EYZ (see Reference 1), substituting NPN silicon transistors for the PNP germanium types. It was noted in the author's experiment that any appreciable amount of ALC feedback would cause the unit to multivibrate. Even if this was not happening, the ALC voltage would have a sawtooth waveform, which manifested itself in a speech waveform having a sawtooth baseline and a variable gain from one peak to the next. The reason for this behavior is that the ALC feedback circuit, for desirable time constants, will pass frequencies which can be amplified by the amplifier stages.

The above problem was recognized and a solution found some years ago (see Reference 3). If the amplifier whose gain is controlled has a push-pull configuration and the ALC voltage is applied to the tubes or transistors in parallel, then, as a first-order approximation, if the stages are perfectly symmetrical, there can be no AF feedback in the ALC loop. I have designed such a system, followed by an adjustable clipper and a low-pass filter.

The equipment has been designed in accordance with the criterion of an ALC attack time of no more than 10 milliseconds, to insure reduction of initial peaks, and a release time of about 300 milliseconds, to accommodate changes in voice level and yet not permit the background noise to rush in too quickly when the voice is interrupted.

Block Diagram

Figure 2 is a block diagram of the processor. An isolation stage consists of a source-follower FET, offering high impedance to a microphone and driving a single-end to push-pull converter through a manual gain control. This stage drives a push-pull IC amplifier with ALC, whose output is then converted back to single-end. This output drives a two-stage amplifier feeding an ALC voltage generator. It also feeds a clipper and low-pass filter. The clipping level and the filter output are controlled manually. The ALC generator feeds a bias-control stage which provides the correct bias range for controlling the push-pull amplifier.

Circuit Details

Figure 3 is the circuit diagram. The source-follower FET at Q1 is zero biased through R1. R2 is a 91Ω isolation resistor to prevent parasitic oscillations; R1 and R2 join directly at the source contact. Q2 provides audio voltages equal in amplitude and 180° opposed at R6 and R7 to drive a push-pull stage. The push-pull, ALC-controlled amplifier U1 is an RCA type CA3028A integrated circuit, shown in detail with numbered terminals. The transistor below the differential pair controls the gain of the system by means of ALC voltages applied to terminal 2.

The output of terminal 8 of U1 goes to Q3, an emitter follower used to provide a low driving impedance. The opposite-phase output at terminal 6 goes to a phase inverter Q4 driving emitter-follower Q5, which also provides low driving impedance. The outputs of Q3 and Q5 are now of the same phase. Before combining in capacitors C11 and C12, they must be equalized in amplitude. This was done in our case by placing an 100,000Ω resistor, R20, across R21. The combined audio signal, now single-ended, drives the two-stage amplifier using Q6 and Q7.

One output of Q7 goes to the high-impedance input of FET Q8 so as not to apply a distorting load across the audio

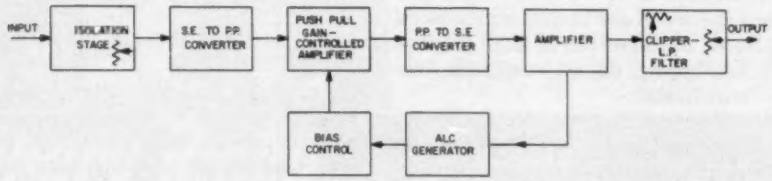

Fig. 2. Block diagram of speech processor.

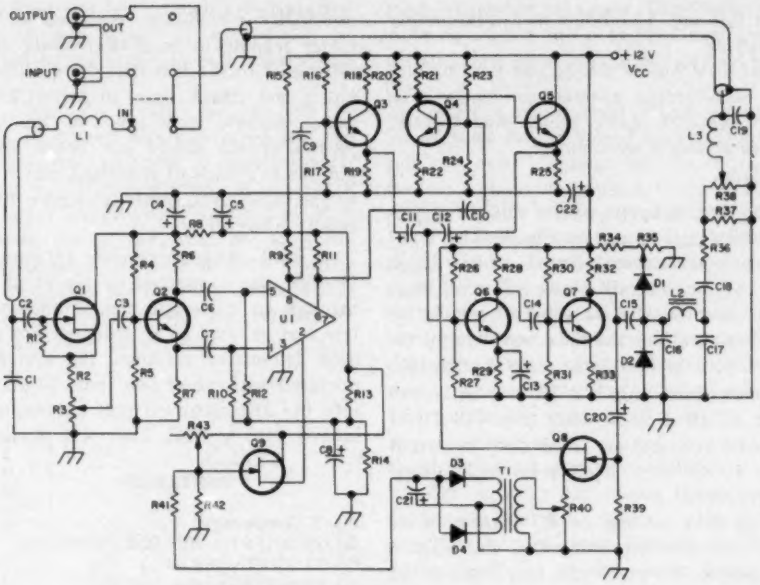

Fig. 3. Speech processor circuitry

output of the system. Q8 is an emitter follower driving transformer T1, which in turn drives a full wave dc rectifier supplying the ALC voltage. The magnitude of the feedback voltage is controlled by R40, an internal 2000Ω 0.1 watt trimmer pot, which is set safely below a point of system instability. Insufficient response to low frequencies, as when the primary T1 is too small, results in too little ALC for the low frequencies and thus overall enhancement of lows in the audio output.

The ALC voltage actuates Q9, a source follower used as bias control for the CA3028A. Q9's source is connected to terminal 2 of the latter. R43 is a high-resistance trimmer pot, or an experimentally determined fixed resistor of perhaps 220K, which may be needed to bring the source current to about 2 mA when the unit is idling. Higher currents made the experiment unit unstable, and lower currents afforded too little ALC. Actually R43 was not installed in that unit; several FET's were tried until one was found which gave the correct current at zero bias. R41 was used essentially to interrupt the dc lead at the gate terminal, so as to avert parasitic oscillations.

The second output of Q7, through C15, is clipped by D1 and D2, with the clipping level adjusted by an external control, R35. At the highest resistance positions of this control, the diode bias voltage is above the level where any clipping occurs, even for the tallest peaks. Filtering is done by the pi network, C16, L2, C17. L2 is the same unit used by WB2EYZ (Reference 1). In that text the values of C16 and C17 were 0.005 μF. However, when those values were tried, the high-frequency roll-off was 3 dB down at only 1500 Hz. When 0.0015 μF capacitors were used, the corresponding point came at 2700 Hz. Neither design was strictly in accordance with theory.

R38 is an externally controlled output potentiometer. Note that the audio voltage is increased by Q7 to insure good controlled clipping. After clipping and filtering it is reduced by the combination of R36, R37 and R38, to produce outputs of similar magnitudes to that of the microphone alone.

Since trouble can be experienced with rf feedback, microphone and other audio cables should be short. L1C1 and L3C19 are

for rf filtering. The inductors can frequently be omitted.

The 12V power source can be a battery or a well-filtered ac-powered supply. The small imported units which plug directly into an ac socket work nicely.

Operation

The ALC behavior of the unit at full gain at 1000 Hz is shown in Fig. 4. The input reference level was selected arbitrarily as 31.6 mV rms (10 dB above 10 mV), since this is near the highest value of intelligible speech output for the most sensitive microphone used in the tests, an RCA HK 107. The data show only a 2 dB drop in output for a 20 dB drop in voice level (18 dB of compression), and an 11 dB drop in output for a 40 dB drop in voice level (29 dB of compression).

High gain settings of R3 correspond to heavy compression. But when the voice is interrupted, too much gain may result in the appearance of undesired audio signals: background noise, hum and breathing sounds, as well as room echo. At top values of R35 there is no clipping, but as values are decreased, the highest peaks begin to be clipped. For somewhat lower values, the intelligible portion of the waveform begins to be truncated and the output amplitude is lowered. This loss of gain must be made up by increasing the settings of R38. The system, surprisingly enough, is usable even with the severely truncated speech waveforms observed on an oscilloscope when R35 is set to zero, but, the more severe the clipping, the stronger the undesired audio signals relative to the desired signals. With reduced compression and heavy clipping, some undesired signals may be present all the time.

Tests were made to measure the effect of the processed speech upon a receiver S meter, and to evaluate real gain in intelligible speech. The unit was used to modulate an old Viking Invader 200 watt p.e.p. transmitter driving a dummy load. For each setting of the processor controls and for no processor, the system audio gain was adjusted to just below rf flat-topping.

In testing with voice signals for the various conditions of the processor, essentially no change occurred in the S meter reading in an R4B receiver. This is attributed to the fact that the receiver AGC has a fast attack time, so that it gave the same response to a spike of the uncompressed speech driven just below flat topping, as to a burst of processed speech driven to the same level. Other tests gave different results, however.

A well shielded receiver (Hammarlund SP-600) was connected by means of cables through an rf decade step attenuator to a few feet of wire as an antenna. For significant attenuator readings, the system was operated with never less than 20 dB dialed into the attenuator so that antenna always looked into a 50Ω load. The transmitter

PARTS LIST

Fig. 3. Components
Q1,Q8,Q9 FET-1, HEP 802, 2N3819, etc.
Q2-Q7 2N697, HEP 54
U1 CA3028A D1-D4 1N270
L1-L3 2.5 mH rf choke
L2 3.5 H miniature audio choke, UTC DOT-8
T1 GC Co. D1-728 transformer. For primary, use half of 500Ω CT secondary. For secondary, use 1000Ω CT primary.

Capacitors
C1, C19 0.001 μF
C2 0.005 μF
C3 0.05 μF
C4, C5, C8, C22, 100μF 15V
C6, C7, C9, C10, C15, C18 0.1μF
C11, C12, 10 μF 15V
C13 30 μF 15V
C14, 0.02μF
C16, C17 0.0015μF
C20, C21 6 μF 1.5V

Resistors (all except potentiometers 1/2 watt)
R1 2.2M
R2 91-R3 10K audio-taper pot
R4, R16, R23, R26 180K
R5, R17, R24 56K
R6, R7, R18, R19, R21, R22, R25, R34 4.7K
R8, R14, R15, R29, R33, R41 1.0K
R9, R11 10K
R10, R12, R37 47K
R13 2K
R28, R32, 3.9K
R30 120K
R35 5K pot
R36 24K
R38 50K audio taper pot
R39 100K
R40 2K trimmer pot
R42 30K
R20 See Text
R27, R31 33K

dummy load was fed through a T connector so that a few inches of wire could be connected to the high side as a transmitting antenna.

An admittedly crude set of tests of listening to oneself was conducted and the step attenuator adjusted to something resembling equal intelligibility of processed speech after unprocessed speech had been used. With almost full ALC, the RCA HK 107 microphone showed 5 or 6 dB of voice power advantage for a variety of processing adjustments, even though the transmitter already had some built-in ALC.

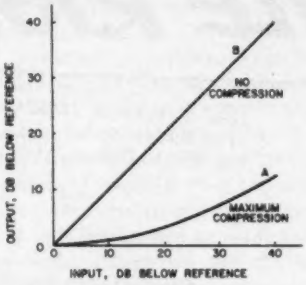

Fig. 4. Compression characteristics: a. maximum compression; b. no compression.

Another indication of enhanced speech power was that during transmission with various processor settings and with the transmitter always adjusted just below flat-topping by any portion of the speech waveform, an rf wattmeter showed three to over four times the average output power of unprocessed speech.

On-the-air tests uniformly brought comments that the processed signal was better than the unprocessed signal, the best quality being with heavy compression, associated with fairly high input gain, and a moderate amount of clipping. Less compression with severe clipping appeared more distorted, but very readable, to some listeners. This adjustment seemed to some to be "the kind of thing to get through in a pile-up."

One reason the processed speech is superior to the unprocessed speech appears to be because the time intervals between the spikes of Fig. 1 are now filled with intelligible speech, where noise or interference might otherwise take over. This "fullness" is quite noticeable and beneficial, even though the speech is only of communications quality.

No doubt a directional or noise-cancelling microphone should permit the use of greater gain or more clipping; efforts should be made to eliminate sources of hum and rf pickup as well as of equipment audio hum.

It is evident that with equipment designed to operate below the legal power input limit, the useful sideband output may be increased by at least 6 dB, with comparable input increase. However, one has to be concerned as to whether the output-tube dissipation and the power-supply capacity will handle the extra load; i.e., the linear dynamic range of the output stage has to be the limiting factor in power-output capability. The author's old Viking Invader meets these requirements. When a linear final amplifier is used, legal limitations make it necessary to see, in the United States, that the average input does not exceed 1 kW under processing conditions.

Conclusions

The speech processing unit described above offers the user a flexible modulation system with the capability of controlling a number of parameters in order to optimize transmitter output in accordance with the user's voice and operating habits, and the characteristics of the rf equipment he is modulating. It should be especially useful in "beefing up" low-power gear. The effectiveness of all solid state transmitters should be enhanced by incorporating speech processing circuitry similar to what has been described.

...WØYBF

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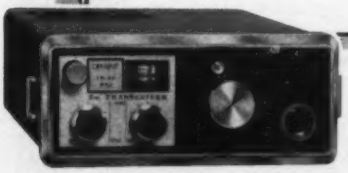

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A TWO-TONE TEST GENERATOR

In the testing of amplifiers and other devices associated with Single Sideband systems, the two-tone test has achieved a great degree of acceptance. Regardless of how the test is performed, whether looking at the output of the device under test with an oscilloscope (amplitude vs time) or with a spectrum analyzer (amplitude vs frequency), the basic input requirement is two good sine waves. In the laboratory, such a two-tone signal is usually obtained by using two good quality audio oscillators, like the Hewlett Packard 204C, and a resistive adding network.

In amateur testing, two-tone audio test signals are usually of much poorer quality, being derived from mike-preamps switched into oscillation by various types of frequency-dependent feedback networks.[1] Even commercial "station monitor" systems often use only a pair of simple phase-shift oscillators (without *negative* feedback or automatic amplitude control). Although such simple methods of obtaining test tones are useful, they often yield test tones in which each sine wave contains appreciable distortion (contains harmonics), and this lack of purity can be incorrectly ascribed to distortion in the system under test. Basically, what it comes down to is that if your input tones aren't pure, you can't really tell how much distortion is from the test tone generator and how much is from the system under test. A really good two-tone test generator will help us to "separate the sheep from the goats."

The two-tone generator described here uses two of the same basic Wien Bridge oscillator circuits as are used in most laboratory-type audio generators. However, by using modern Integrated Circuit (IC) Operational Amplifiers (op amps), each Wien Bridge can be built around a single semiconductor package. Op amps are also used as active bandpass filters to further clean up harmonics of the two oscillators, and to sum the two pure tones. The block diagram of the generator is shown in Fig. 1.

The particular oscillator circuit used is a form of Wien Bridge originally described by Bob Botos of Motorola.[2] Its charm is that he uses a pair of back-to-back silicon diodes as the non-linear control element. Such a pair of silicon diodes is probably much more readily obtained, and less expensive, than a particular light bulb or thermistor – as used in most Wien Bridge circuits. The diodes prove be very effective as non-linear elements; and they do not cause severe waveform clipping because of the 47K resistor in series with them. The 1K pot that is in the same arm of the bridge as the non-linear diode elements (R1 or R2), is used to set the oscillator level. This pot should be set to give a 10V peak-to-peak output at T.P. 1 (and T.P. 2).

The active bandpass filters that follow each audio oscillator are described in detail in References 3 and 4. The use of this form

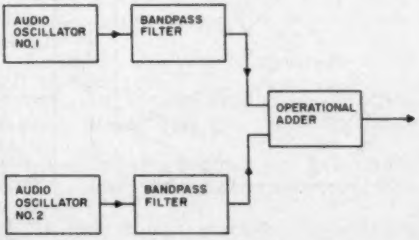

Fig. 1. Block diagram of the tone generator.

of active bandpass filter as a single-control variable-frequency audio filter is apparently due Bob Dobkin.[5] An idea of how a filter composed of nothing much more than R's, C's, and an operational amplifier can have selectivity, can be gained as follows. The R-C network that controls the frequency is connected between the output of the op amp and its inverting input – that is, in the negative feedback path. The R-C network is reminiscent of the bridged-tee *null* network. At the network null frequency, the negative feedback is the lowest, and therefore the closed-loop amplifier gain is the highest. The frequency of the passband is adjusted by means of the 1K pot in the R-C network to match the oscillator frequency. (Adjust R3 for a maximum 2000 Hz output at T.P. 3, and adjust R4 for a maximum 800 Hz output at T.P. 4.)

The particular IC op amps used in the active bandpass filters are LM301A's by National Semiconductor. These op amps are compensated in a way referred to as the "feed-forward" method of compensation. This way of compensating op amps allows them to have higher slew rates than with the normal single-capacitor compensation usually used with LM301A'S. The "feed-forward" compensation method is described at some length in Reference 6. Because this type of compensation is used in the active bandpass filter op amps, it would probably not be too good an idea to use other types of op amps here. The op amps used in the oscillators and operation adder, however, can be any of a variety of types. The MC1456 of Motorola or μA741 of Fairchild should serve well in these positions (with the 33 pF compensation capacitors omitted). Of course, there are a number of exact equivalent of the LM301A, MC1456, and μA741 made by a variety of companies other than the originators – these are not to be considered replacements but second sources. One could probably even use μA709's if he understands how to properly compensate them (and wants to go to all the bother); but if you are at all uneasy about substitutions, use LM301A's throughout and the circuit of Fig. 2.

The last stage is the operational adder, or summing amplifier. This op amp is operated at a closed-loop gain of 1. The summing point of the two pure sine waves (2000 Hz and 800 Hz) is at the inverting input of the op amp. As connected, this port is a 'virtual" ground; if you look at this point with a

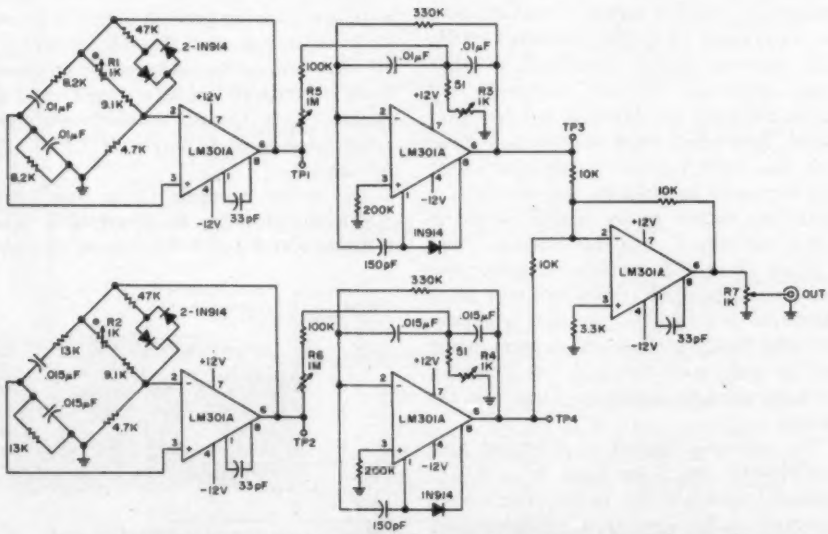

Fig. 2. Schematic diagram of the two-tone test generator utilizing Wien Bridge oscillators.

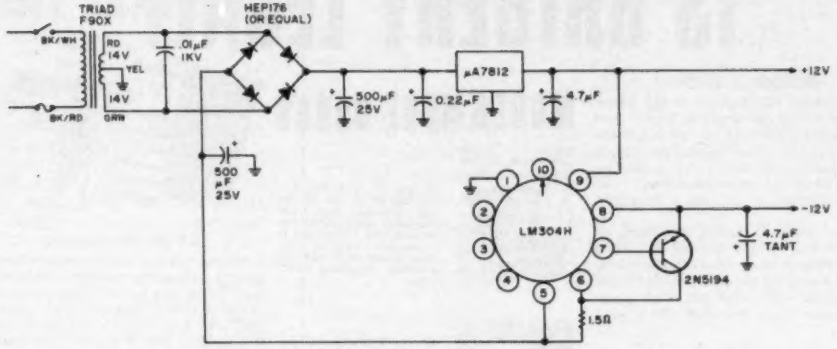

Fig. 3. Dual voltage regulated supply used to power the tone generator.

scope you will see nearly zero voltage. This is simply because the (high gain, 80 dB) op amp strives to keep the differential voltage between inverting and non-inverting input at zero, and so the non-inverting input is effectively grounded. So each sine wave "sees" the summing amplifier as 10K to ground; and the two sine wave generators cannot interact with each other to cause distortion. The summing amplifier is a true algebraic summer, which is why operational amplifiers thus connected were originally used in analog computers. If one sine wave is instantaneously at +5V and the other is at −3V, the output will be +5 −3 = +2V. And since there is no coherence between the 2000 Hz and 800 Hz sine waves, we can expect to see plus and minus voltages as high as twice the peak value of each sine wave (±10V peak, or 20V peak to peak). This should be more than enough level for most two-tone testing. The level of each sine wave can be controlled by the 1 Meg pot at the input to each active filter (R5 and R6).

Measurements of the output of the two-tone generator described above, with a General Radio 1900A Wave Analyzer, show that (for equal level tones) the harmonics and cross products are all down more than 70 dB from the desired tone. This sort of purity should be more than adequate for testing any amateur communication system.

A simple, but well-regulated power supply for the two-tone test generator is shown in Fig. 3. An integrated bridge rectifier is used with a center-tapped secondary transformer as a plus and minus full wave rectifier. Plus 12V is simply obtained by use of one of the new fixed-voltage three-terminal regulator IC's of Fairchild, the μA7812. This IC looks like a plastic power transistor (UGH 7812 393) and its common terminal is the heat sink lab. So screw it right to the chassis if you want to – with no mica washers, grease, etc.

The negative regulator is slightly more complicated, but still simple. The National Semiconductor LM304H is used, with the regulated +12 serving as its reference voltage. In this way the plus and minus voltages *track*. A 2N5194 plastic power PNP transistor is used to increase the current capability of the LM304H. The 2N5194 must be heat-sinked in a conventional way, using insulating washer, etc., if the chassis is used as the heat sink.

. . .W6GXN

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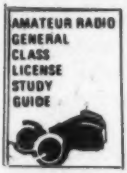

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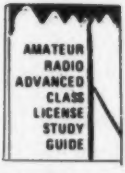

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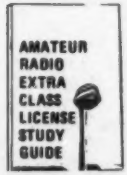

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EDITORIALS

The editorials in 73 pull no punches. Nothing wishy-washy. It is safe to say that unless you read the editorials in 73 you cannot know what is really going on in our hobby.

Did you enjoy the article in August on the DXpedition to Navassa? This is one of the reasons that 73 is different – it is involved. The editors get out there and operate, go on DXpeditions, organize them even – organize ham tours – set up repeaters – work in the contests – work lots of DX – are actually on slow scan – on RTTY – it makes the magazine come alive. When the editors write about something you know that they have the background to bring you the inside scoop.

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SPECULATIONS ON FUTURE DX

Most radio amateurs in the world know that the sunspots control ionization of the upper atmosphere, hence DX propagation. But not many of them pay much attention to propagation – amateur radio is their hobby and they either "get through" on a QSO or they don't. If conditions are "bad" they accept the situation and work contacts closer to home.

There are a few amateurs, however, who are definitely interested in the sunspots in a scientific sense and the relationship to DX propagation. These men wait for the Zurich Solar Observatory results each month and carefully watch the various forecasts. Like these men, I have been interested in the sunspots for many years and each month plot the results from Zurich.

We have some history of the sunspot counts since 1749. This article considers this past history, and speculates on what that history may be trying to tell us. It also speculates on what the sunspot story might be in the near future and correspondingly, what DX propagation might be. Some suggestions are included as to how amateurs might cope with low DX propagation conditions.

Figure 1 shows the past history of the sunspot counts. It is plotted by years using the 12 month running smoothed sunspot numbers on the vertical axis. Years are used on the horizontal axis. Also shown are the cycle numbers, from 1 to the present cycle 20, which will end about the middle of 1975.

Before looking at Fig. 1 in detail, let us agree that the results shown are not finite. They are the results of telescopic observations of the sun made by numerous ob-

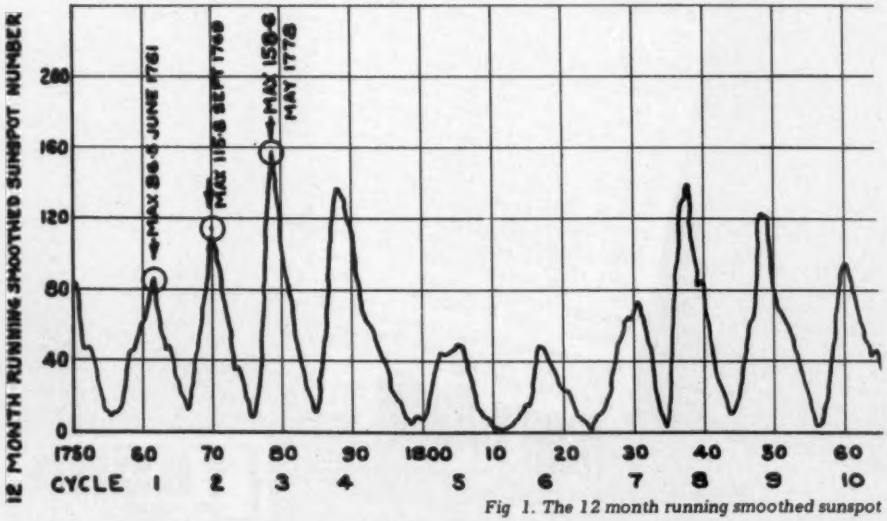


Fig 1. The 12 month running smoothed sunspot

servers. Since the sunspots themselves may only last for a short interval of time, counts between observers may vary. This was recognized in 1849 by Rudolf Wolf, Director of the Zurich Solar Observatory, when he developed the formula to care for the variations in observers, their equipment and their observations. His formula is still in effective use today. So we will not concern ourselves, in general, with the actual sunspot numbers, but rather look at the broad picture presented in the past history available to us.

Now, looking at Fig. 1 we note some interesting points –

1. Cycle 1 seems to start increasing activity on the sun's surface. Cycle 2 was greater, cycle 3 quite high, then the activity fell off. Cycle 4 was lower and cycles 5 and 6 quite low. After the activity of cycles 1, 2, 3 and 4 did the sun "rest" from 1798 to 1823, about twenty-five years or so?

2. In cycles 7, 8, 9, 10 and 11 there was an increase in activity, but seemingly of a random nature. Cycles 12, 13 and 14 were much lower in activity, but higher than cycles 5 and 6. Was the sun's thermonuclear reaction "resting" again after the activity of cycles 8, 9, 10 and 11?

3. In cycle 15 increased activity took place, but this may again have been of a random nature since cycle 16 decreased considerably following it.

4. Cycle 17 started off fairly high, followed by increased activity in cycle 19. Cycle 20 seems to have repeated the falling off of cycle 4, although of somewhat lower value.

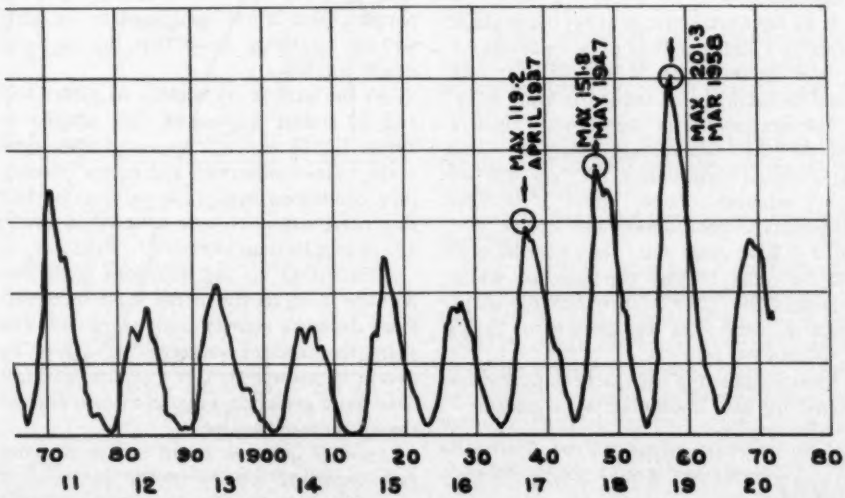
In all our thinking on these points there are several thoughts we must keep in mind –

1. We cannot expect to develop anything more than generalizations from the past history of the sunspots since we have only a little more than one complete overall cycle of operations of the sun to consider.

For our purposes we may consider one complete overall cycle as being the length of time from one maximum cycle to the next maximum cycle. For example, this could be the length of time between the maximum of cycle 3 to the maximum of cycle 19, or about 178 years.

2. We have only one overall cycle to analyze and in the history of the individual cycles we have only 19. There is no regularity to the individual cycles. The average cycle appears to be 11.08 years. The individual cycles may vary widely (see Fig. 1).

Some Fourier analysis studies were made in Washington some years ago and tended to indicate a secondary cycle of about 160–170 years in length. However several overall cycles, say at least 2, or 320–340



numbers plotted by years from 1750 to 1971.

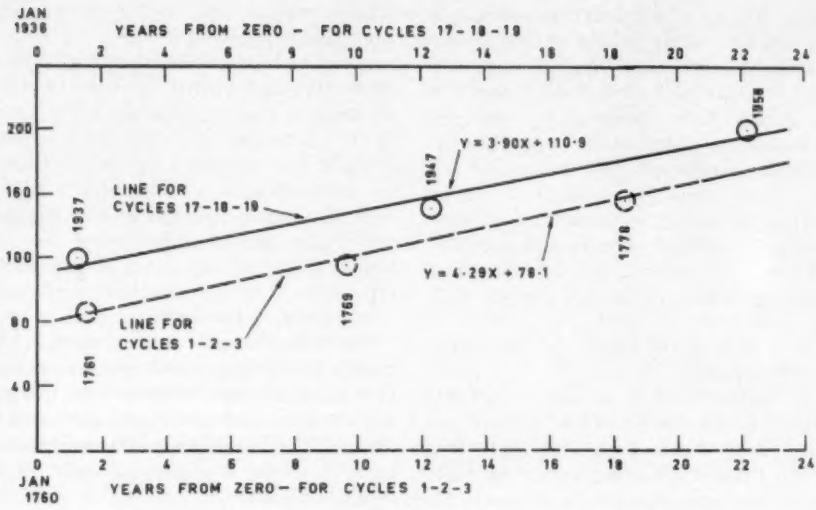


Fig. 2. "Lines of best fit." See text.

years, with associated records, must be obtained before we will be able to conclude there is this overall cycle in addition to the 11 year (approximate) cycles.

The increases shown in cycles 1, 2 and 3, 17, 18 and 19 seem too similar to me to be discarded in our thinking. Let us look at them in more detail. To simplify the mathematical work, only these cycles will be considered.

If we lay a straightedge along the peaks of cycles 1, 2 and 3 and the same on cycles 17, 18 and 19 the "line of best fit" for each group seems to be at about the same slope.

The next step is to check these "lines of best fit" for each group, using the usual mathematical procedures. To do this we must establish "zero dates' for the mathematical procedures. For cycles 1, 2 and 3 I have used Jan. 1760 for the zero date, in order to find the equation which represents the "line of best fit" for them. Similarly, Jan. 1936 was chosen for cycles 17, 18 and 19.

After completing the mathematical work we find we have developed two equations –

Cycles	Equation
1, 2 and 3	Y = 4.29 X + 78.1
17, 18 and 19	Y = 3.90 X + 110.9

These equations represent the lines of best fit. In themselves they do not show what we want – they must be charted to show their relationship. This has been done in Fig. 2.

Examination of this figure indicates the lines to be nearly parallel. Differences in counting the sunspots by the various observers around the world could account for the small amount by which the lines are not parallel. This is not significant to us, what we are interested in is that the lines are nearly parallel.

So the sun, in its activity in cycles 1, 2 and 3, almost duplicated that activity in cycles 17, 18 and 19. Improved telescopes, more trained observers and better observatory conditions might account for the fact that more sunspots were counted in cycles 17, 18 and 19 than in cycles 1, 2 and 3.

This brings up the question, could this indicate a regularity in the sun's behavior? Does the sun's activity peak every 160–180 years, then a short resting period follow? To obtain an answer to this question we must have more evidence, more complete data on the sun's overall cycles.

Another question might be asked. After each burst of activity of the sun, does a resting period always follow? If this is true,

then cycle 21 could be quite low in activity, with a maximum annual mean of about 40–45.

Fortunately we will be able to estimate quite soon what cycle 21 will be like. Cycle 20 is expected to be complete about the middle of 1975 and then cycle 21 will start. If it will be a major cycle, it should start up and increase quite rapidly, month by month. If it is going to be a low cycle, it will increase quite slowly, month by month. The first year should "tell the tale"; i.e. by midsummer of 1976 we should have a fairly good estimate of the maximum activity expected for cycle 21. The maximum should take place about the middle of 1979.

What we will watch for is the "rate of change." Figure 3 shows an example of this action Cycle 19 has been plotted for a few years to show the fast rise in the first few years (up to a maximum of 201). Cycle 20, a lower cycle of maximum 111, is also plot ted. Note the difference in the rate of change in the early years.

Some of the other cycles also show this quite clearly, for example – the fast rise in cycle 3 compared to the slow rise of cycle 6.

If my analysis is reasonable and the sun does rest after a period of activity, then we might expect one or two low sunspot cycles to follow cycle 20. These could last anything up to, say, 25 years in length. In this case, if it is to happen, there could be some things we should be starting to do now to get ready for low sunspot activity. Some of the things we might do are as follows –

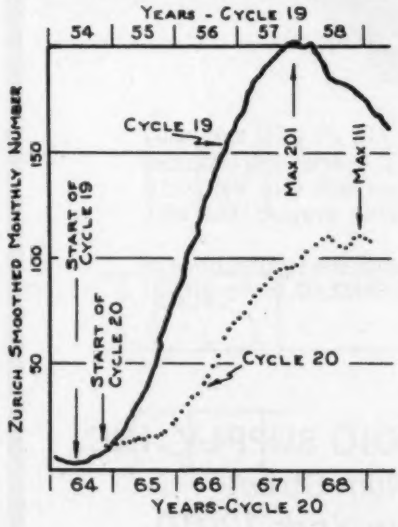


Fig. 3. Rates of increase for a small and large activity cycle.

1. More listening for DX openings. These could last only a few hours – take advantage of them in the time they are available.

In his book *Ionispheric Radio Propagation* Kenneth Davies, of the National Bureau of Standards, makes the statement "The daily values of R vary betweeen 0 and 355 or more." Imagine the band openings for a short time if there was an R figure of 355!

Most DX amateurs know of the possibility of these openings. One day last summer a station in the Indian Ocean was putting a 59 plus 10 dB signal into North America. The condition lasted for just about two hours. I haven't heard him since.

So let us watch for these openings, even if they are of short duration.

2. If the sun rests after a burst of activity then there will be fewer disturbances.

3. On 10 meters I would expect definitely reduced working hours.

4. A fair reduction of good openings on 15 meters.

5. 20 meters may expand in working time.

6. 40 and 80 meter openings should expand.

7. Work should be done to increase the height of the average beam or quad antennas, to obtain the lowest forward angle of radiation.

8. We should all make an effort to help the cause of amateur satellites and learn how to use them effectively.

9. Our operating procedures could be improved.

The amateurs living today are fortunate to have been through the past years and to have had the opportunity of working during cycle 19. What will happen to the sunspots in future years is a function of time. It will be most interesting to continue to follow the monthly sunspot numbers from Zurich and ultimately to determine whether or not some of our conclusions are correct.

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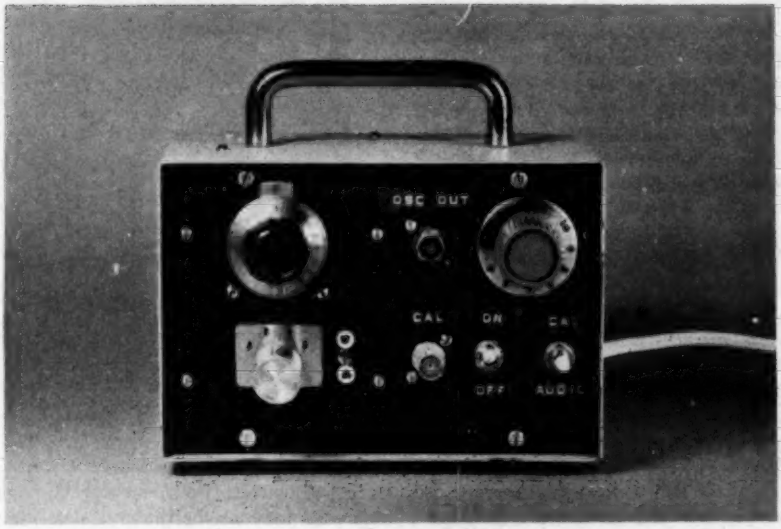


FM TEST SET

How would you like a test set with the following features:

1. Frequency meter for the receiver as well as transmitter.
2. Signal Generator with calibrated output.
3. Deviation checker (with associated equipment).

The need to build up a compact unit came after carrying some heavy test equipment up to a remote amateur repeater site. This test set will also be very handy for checking and aligning your two meter mobile or base station. It is also useful for checking out commercial mobiles if the frequencies are compatible.

Theory of Operation

The crystal oscillator uses one transistor Q1 which is rich in harmonics up to about 450 MHz. The output of which is varied by using a potentiometer to vary the supply voltage. A crystal that will multiply out to

the desired frequency is inserted and put on the exact frequency with variable capacitor C1. This unit in conjunction with an external variable attenuator provides an accurate rf signal source. The mixer consists of the emitter-base junction of a VHF silicon transistor to combine the output of the crystal oscillator with a small portion of the output of the transmitter to be checked. An audible beat will then be heard out of the audio amplifier for frequency adjustments if necessary. The crystal calibrator generates outputs every 30 kHz and is derived from a 3 MHz crystal oscillator and two divide by 10 ICs to give the 30 kHz markers. The harmonics of this device are usable to over 150 MHz. A receiver can thus be put on frequency provided that the receiver is operating on a standard 30 kHz spaced channel. The transmitter can be put on frequency indirectly, a receiver on the same frequency is first put on frequency with the calibrator. The crystal oscillator frequency is then compared and adjusted using the receiver. The transmitter to be tested now is mixed with the crystal oscillator and put on frequency by listening for a zero beat. Deviation can be checked out in conjunction with a receiver and a dc scope. The crystal oscillator is first calibrated 15 kHz below and above the desired frequency. The output of the receiver discriminator is attached to the vertical input of the oscilloscope. The scope can now be calibrated and the transmitter deviation can be checked.

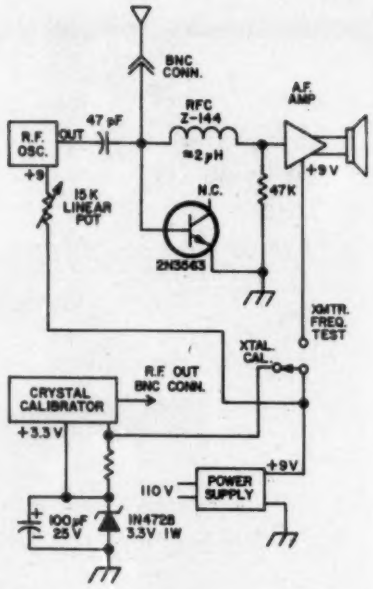


Fig. 1. Overall block diagram and mixer details.

Construction

The complete unit measuresonly 6¼ by 4¼ by 3½ inches. Four separate PC boards were used for building the crystal oscillator, amplifier, power supply, and the crystal calibrator. The overall block diagram is shown in Fig. 1. The crystal oscillator schematic and board are shown in Fig. 2A and B. The frequency of the unit isne not

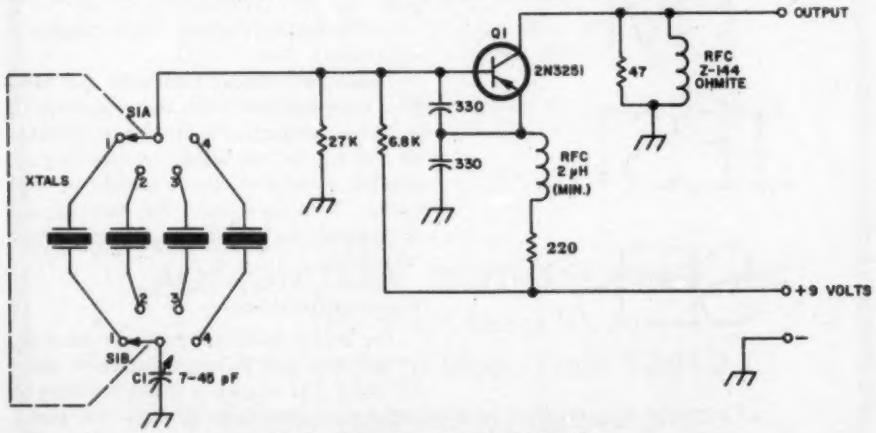


Fig. 2a. Schematic of the crystal oscillator.

Fig. 2b. Full size layout of crystal oscillator P.C. board.

with C1 variable capacitor which is rotated using a vernier dial. Switch S1 can have as many positions as desired. It is advisable to mount one of the crystal sockets on the front panel. The output level is adjusted with a 15,000Ω pot and should be linear taper for smoother output variation.

The audio amplifier uses a TA300 IC to produce about 1 watt output. The speaker used came from an old transistor radio. Any high gain amplifier could be used here. A VHF silicon diode is required for the mixer. One was not readily available so the E-B junction of a 2N3563 transistor was used.

The crystal calibrator schematic is shown in Fig. 3. The unit is available in kit form. I priced out the individual components and found that it was less expensive to buy the kit than buy components individually. The MC-724 IC serves as an oscillator and amplifier. Two MC-780 are used and serve as dividers which divide by 10. The unit can be calibrated against an electronic counter or against the 15 MHz WWV signal.

The power supply provides a regulated 9 volts using a Motorola MFC 6030 IC regula-

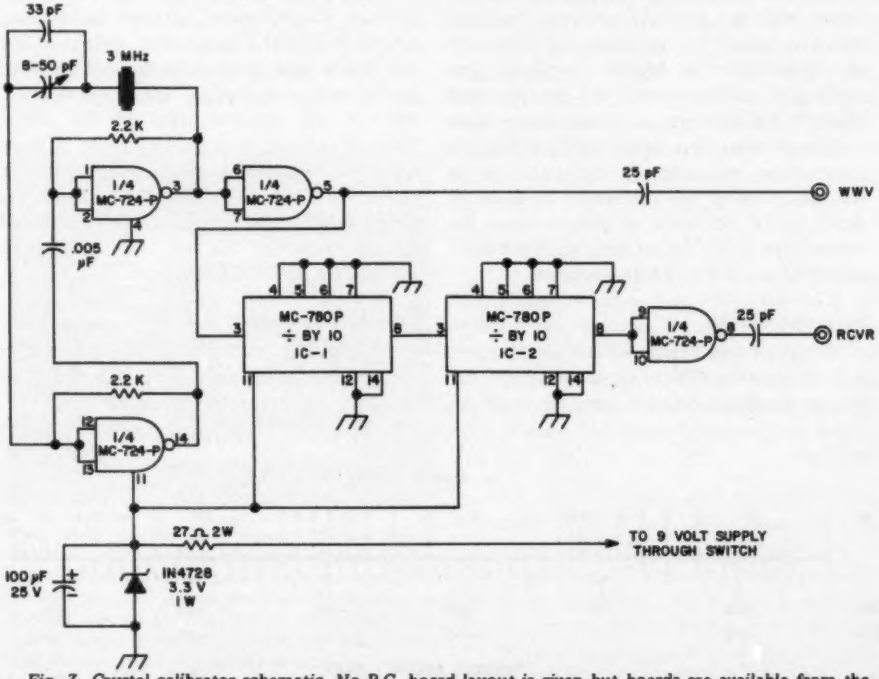


Fig. 3. Crystal calibrator schematic. No P.C. board layout is given but boards are available from the source given in the text.

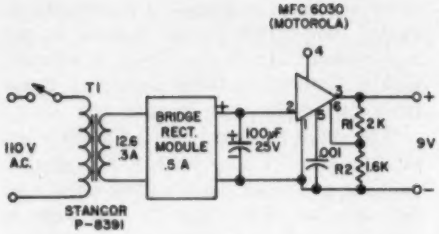


Fig. 4a. Power supply schematic. Voltage can be varied by changing the R1/R2 ratio.

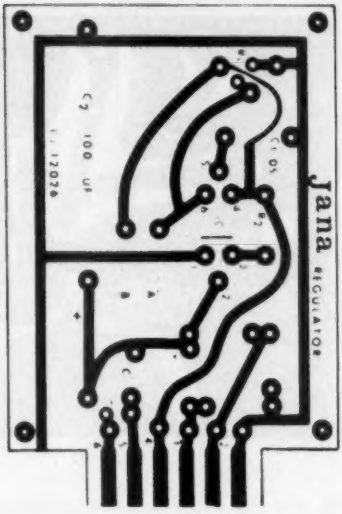


Fig. 4b. Full size layout of power supply board.

tor. The schematic and P.C. board are shown in Fig. 4A and 4B.

Operation

The crystal calibrator can be used to check any two meter channel provided it is a standard 30 or 60 kHz spaced one. To determine if the frequency to be checked is standard just divide by 30. It must work out evenly; e.g. (146.94 will divide by 30). The receiver padder can now be adjusted for a zero discriminator reading. The transmitter is checked indirectly by using another receiver and the crystal oscillator. Suppose that you would like to check the frequency of a transmitter on 146.94. You must first apply the calibrator to the receiver and verify that the receiver is on frequency. Next a crystal with the right multiplication is inserted in the test set and adjusted on frequency using the calibrated receiver. A short piece of coax is placed near the transmitter to be tested and adjusted for a zero beat (switch to TX frequency).

Deviation Checks

Deviation can be checked in conjunction with a receiver and a dc scope. First the crystal oscillator in the test set must be calibrated against a good standard for a frequency plus or minus the desired frequency. A calibration chart can be made up for each crystal desired. The output of the test set is now applied to the receiver. The discriminator output of the receiver is applied to the vertical input of the scope. Vertical calibration is accomplished by moving crystal oscillator from desired frequency to plus or minus 15 kHz for a reasonable scope display. The scope is now calibrated and modulation can be applied to the transmitter under test.

Calibrated rf Generator

The crystal oscillator in the test set in conjunction with an rf attenuator can be used for an accurate calibrated rf source.

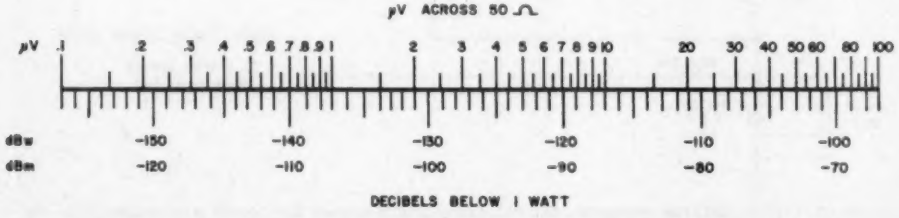


Fig. 5. Chart to be used in conjunction with the crystal oscillator and an rf attenuator.

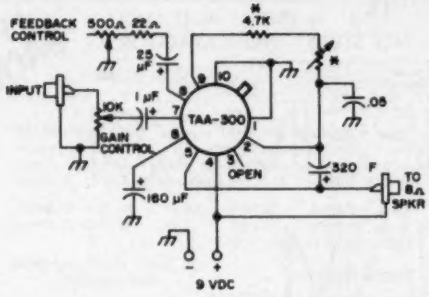
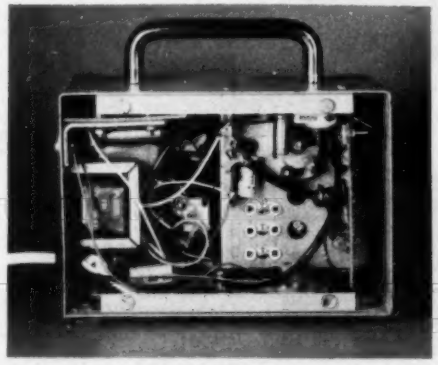


Fig. 6a. Schematic of the audio amplifier.

The rf attenuator must have a usable range up to 150 MHz. I used a Jerrold Model A-72 attenuator with the unit to provide up to 82 dB of attenuation. First the signal generator must be calibrated against a known rf source. I found that my four crystals at 6 MHz range varied no more than 10%. Next the crystal oscillator output must be set up for a reference output. Say you choose 70 μV. From the chart in Fig. 5 this corresponds to −70 dBm. Now the rf attenuator can be put in series with the output and set for any value desired. For example, the crystal oscillator is set up for 70 μV, the attenuator is set for 31 dB. From the chart 70 μV corresponds to −70 dBm. If we add 31 we have a signal of −101 dBm. This corresponds to 2 μV. We could use dBw instead of dBm and get the same results. *Note: dBm – is the power in dB relative to 1 milliwatt; dBw – is the power is dB relative to 1 watt.*



Rear view of the unit showing circuit board placement. The audio amp is mounted along the top at the left with the crystal calibrator next to it at the right. The crystal oscillator circuit board is vertical next to the right wall of the cabinet. The power supply is tucked between the transformer and speaker. Note the subchassis used for mounting the vernier oscillator capacitor and crystal sockets.

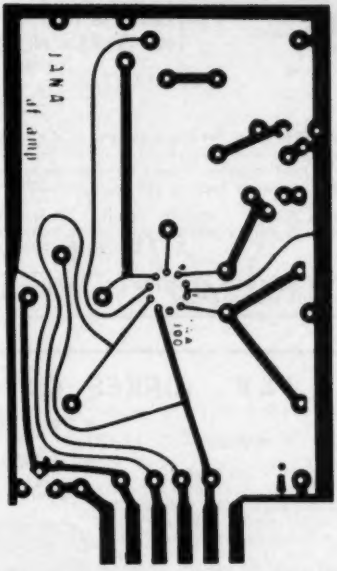


Fig. 6b. Full size audio amplifier P.C. board.

Summary

I think you will find this test set very useful for servicing and checking both repeaters and mobiles. It may be desirable to install a nicad battery with charger so the unit becomes truly portable. I have used this test set on some of the commercial frequencies around 160 MHz with excellent results.

. . .VE7ABK

The P.C. boards are available from *Camgard Supplies Ltd., 2055 Boundary Rd., Vancouver, B.C.* The three available are for the power supply, the crystal oscillator and an audio amplifier. Each board sells for $2.00. The crystal calibrator board sells for $4.25 from *Perfection Electronic Products, 404 E. Harrison, Royal Oak MI.* The complete kit is $19.95.

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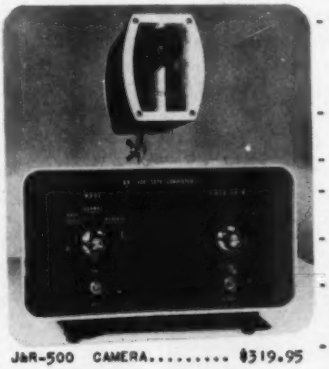

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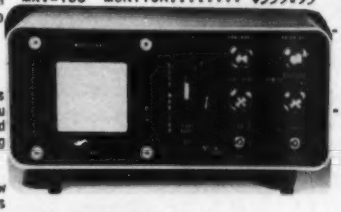

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DX-MISSING MADE EASY

Winner of the most DX-missed award

As honorary president and lifetime member of the International DX-Missers Club, I was recently asked to speak on the topic of Blowing Rare Ones by a local ham group, and my remarks drew so much comment that I decided to condense them into an article for *73*.

In this way, it is hoped some of the rewards of failing consistently to hook DX stations can be relayed to others of the amateur fraternity who covet the awards, certificates and sense of accomplishment that come to dedicated and skillful hams who sharpen their talents for chasing and missing.

In all modesty and only to display my credentials as an authority on the subject, I cite my logs and my lack of QSL cards to prove I have accumulated over the years a total of 347 countries missed.

Not only that, but on one memorable day last August I racked up a five-band missed-all-continents record within a three-hour period.

And twice I have come within one blow of the real Hat Trick: missing all zones in a single operating stint.

This, I certify, all has been done on a somewhat limited operating schedule, always as a single-operator activity using a multiplier of zero.

Now granted, anybody with talent, patience and a willingness to learn from past mistakes could have accomplished these goals with extreme QRP and a non-radiating antenna.

But, in all cases, my own achievements have been racked up with reasonable power (a quarter-gallon) to a three-element yagi atop a 50 ft. tower, everything peaked for maximum yield, the rotator properly calibrated, and the feedline hooked to the rig.

That's where true skill shows up in results.

I'll touch on one more phase of my attainments to complete my showing of credentials and prove the rewards that flow from sharpening your DX-Missing skills before getting into the here's-how-you-too-can-learn-to-blow-them portion of this verbal seminar.

The proof of the pudding, so far as my abilities in this difficult field are concerned, lies in the awards that have come to me as a consistent misser of rare and common DX.

I am the holder of certificate number one from the How Come Nobody Can Hear You Even When the Band is Open? club of America.

I have on my shack wall the first Outstanding Amateur award ever issued to any U.S. ham by the International Organization of Your Key Clicks are in There But Where's Your Signal?

I own the original, though chipped and fading, ham-of-the-year plaque for 1957 from the A-2 Operator's Club bearing the inscription, "For Outstanding Contributions to the State of the Art of using Tri-Bander Beams as True Non-Radiating Dummy Loads."

And I am expecting almost momentarily the ultimate star for my crown of achievements, the gold-inlaid handkey screwed to

the rear end of a plywood cat, inscribed: "To K9AZG, The Only Active Ham in North America Who Missed San Felix Island, CE0, While Hanging in There Reasonably On-Frequency with Reasonable Power."

Hunh?

But enough about me. Now about you!

If you have any modicum of talent as a strike-out champion in the ball game of chasing DX, you can improve your latent skills by mastery of a few simple rules.

1. Always zero atop the biggest and best signal in any pileup when calling a new one you intend to miss.

2. If and when that big signal hooks the DX, rezero atop the next loudest caller.

3. When working sideband, set your VOX to trip the rig in at the fifth syllable and to drop out between words.

4. When working CW, double or halve your speed to call slow DX operators with burp-gun rapidity and fast ones at five words per minute.

5. Time your calls to double with the DX for at least a portion of each of his transmissions.

6. On phone, call the DX with whatever accent he is using, exaggerating it as much as your talent at mimicry allows, and giggle a lot.

7. On CW, set your bug or electronic keyer to produce dots and dashes of precisely the same lengths, preferably two bauds each.

8. Call a lot and listen little.

Those, then, are the basic and cardinal rules to learn if you wish your career as a DX-misser to flourish.

There are other tricks, but mainly they are variations or refinements of the essential eight which you can hear on the air any time the bands are open and so emulate for yourself.

One final word, however. Since hams are gentlemen and gentlemanly, it is of course unthinkable that any true amateur would cheat to accomplish his desired goal of winning laurels as a DX-misser.

But there are those short-cut artists – mainly pirates, bachelors and phone men – who do so.

For their benefit, and for those who might be tempted to follow in their footsteps, the following ploys are considered unfair, unethical, uncouth and unscrupulous tactics, and any DX-misser caught or even suspected of employing them is automatically ineligible as an award winner.

It is not cricket to:

1. Call a DX station more than 50kHz off his frequency.

2. Tune up the beam for maximum SWR, minimum gain or poorest front-to-back ratio.

3. Key or modulate the buffer-driver without including the final or turning on the high voltage.

4. Call everything off the back or side of the beam.

5. Call sidebanders on AM or phone DX on CW.

6. Detune the final from resonance or the antenna coupler for minimum energy transfer.

7. Send a string of breaks without signing your call from time to time.

But of course no right-minded ham would do any of these things, rumor to the contrary notwithstanding . . . would he?

. . .K9AZG

Donald J. Marx W2ANT
32 Farm Road
St. James NY 11780

INSTALLATION AND METHOD of TILTING A 60 FT TOWER

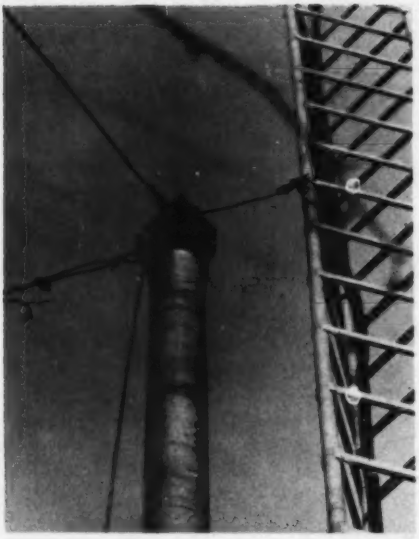
This article presents a method of raising and lowering a 60 ft tower with a 21 ft Comm Products omnidirectional antenna on top.

I would like to start out by giving a little background story. I am one of those chickens who think they can climb a tower until I get up to the 20 ft level – then I get what is known as white knuckles. Not realizing this until after I purchased this free-standing 60 ft tower, I was faced with the task of tilting it over or getting a monkey every time I needed antenna work. The tower comes in 10 ft bolt-together sections. I acquired it from a local ham who had a full 20m beam on it completely unguyed for over seven years, which withstood many a good storm. The tower is made by Jontz, which is advertised in all radio master catalogs, dating back at least to 1965. I have the heavy duty model No. 500 which I strongly advise for the service which is about to be described.

I contacted the Jontz Company in order to obtain a new base, as the original one stayed behind inside a block of concrete. During the conversation it was revealed that there is a tilt-over base available to tilt this monster if the proper rigging is used. Hence this article.

Mounting Base

First a hole was dug 3 feet deep by 3 x 4 wide. A wooden frame was built with 2 x 4's level on top of the ground surrounding the hole. This results in a finished job above ground. This frame also helped to support



the tilt-over base during the pouring of concrete.

Rigging Pole

The rigging pole is a permament 4 in. mast which is also embedded in the concrete base. We acquired three sections of 4 in. diameter 10 ft electric conduit with slightly damaged threads. After forcing on two couplings and welding, we had a ridged 30 ft rigging pole. We buried 3 ft in the concrete with 2 ft protruding out the bottom of the concrete into the dirt. This leaves 25 ft standing out of the ground. I believe 3 in. diameter pipe would do the job as well. The raising of this 30 ft pipe was a bit difficult until we had taken advantage of some trees, plus block and tackle. After raising it up and into the hole prior to pouring concrete, we used rope and ground stakes to guy the mast perfectly straight to insure its permanent position. After trueing up the mast and tilt-over base, we proceeded to pour a good concrete mix and allowed two days for it to set before proceeding.

Rigging Pole Pulley

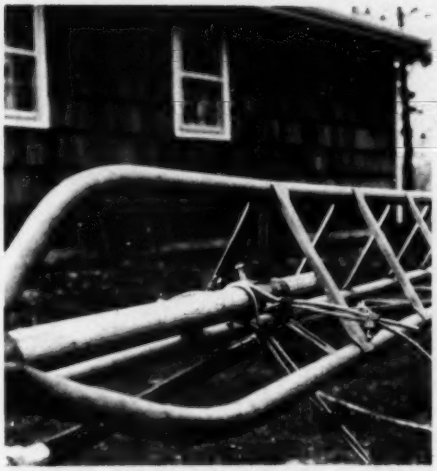
This pulley is mounted on top of the rigging pole to enable a boat winch cable to be routed over the pole via the pulley and act as the pulling point to lower and raise the tower. A steel pulley of good construction is important at this point. I used a steel belt pulley from an old 2 hp motor with a 1 in. shaft diameter. We had taken advantage of one good threaded end of the 4 in. conduit to mount this pulley assembly.

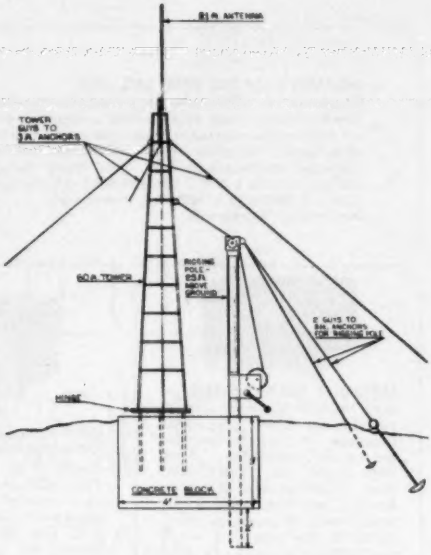
Rigging Pole, Back Guys and Anchors

The anchors are critical along with the guy cable in that if they pull out or the cable breaks, the tower will fall during raising and lowering (enough said). I used 8 ft mushroom anchors similar to the type the lighting company uses for pole guying, but I have to admit they are more than you need. I used two pieces of lighting company guy wire (3/8 in.) which was considered as scrap. This was all secured with two conventional bug nuts at each point of fastening.

Boat Winch

The theory applies here also; if the winch falls apart during lowering, " . . . down will





come tower, antenna and all." By canvassing boat yards I received a donation of a rusty boat winch about 3,000 lbs. capacity. After much wire brushing, a coat of paint and replacing the drum shaft with a 3/8 in. stainless steel bolt (stainless steel has a very high shearing point), I felt safe in proceeding to mount same to the rigging pole, again using stainless steel bolts 3/8 in. in diameter. I would like to point out that there are many low priced inadequate boat winches available with pressed tubing for the drum shafts, etc.; be cautious. The same applies to the winch cable – don't scrimp. A typical boat cable is not long enough, so I purchased a 75 ft cable designed to withstand this weight and pull (3/16 in galvanized 7 x 9 stranded vinyl coated, 4200 lbs.).

Tower Guys

Even though this tower is self-supporting after being raised and found to be stable by a tower climber, I felt that my sleep was more important than proving a point, so I decided to put three guys on the very top. I used 3 ft antenna guy anchors and the same cable as described for the winch. Here a lighter gauge cable could be used.

First Raising

With three guys attached to the tower top lying on the ground and all bolts, bug nuts, etc., tightened, I very nervously grabbed the winch handle with two hands and started to crank. Not realizing a ratio of 6 to 1, I was amazed that it took only minimum effort. As it started to raise higher, I used two hands just in case one decided to quit. With the ratio of the winch it took a while to go up; but indeed it went up and stood there like an 81 ft statue. I locked the winch and bolted the tilt base. The tower was then cautiously climbed with a belt (not by me) to test for stability, which was found to be exceptionally good. Of course the next step was to lower the tower. This worked equally as well as raising. As a matter of fact, the tower went up and down three times that day. The final raising was followed by securing the three guys to the anchors (again, peace of mind).

Conclusion

I would like to make it very clear that I am not a mechanical engineer, nor do I claim to guarantee this safe or foolproof, but it does work. All comments pro or con would be appreciated.

I would like to thank Joe WB2QEB for his original ideas. I would also like to express my deep appreciation to Norm WA2JPZ for his muscle, brains, ingenuity and moral support.

. . .W2ANT

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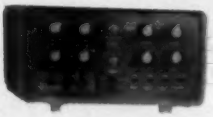

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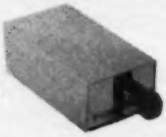

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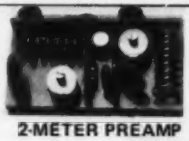

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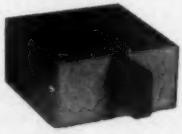

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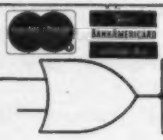

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AMATEUR LICENSING IN JAPAN

It was an article in a late 1971 issue of *QST* that encouraged me to investigate the system of ham licensing in Japan. This particular article said that there were over 230,000 ham licenses there and that Japan would soon overtake the United States as the leader in licenses issued. Why, then, does the *Radio Amateurs' Callbook* list only about 15,000 Japanese tickets?

It's true, now there are almost as many operator licenses in Japan as in the States. But to understand this it is necessary to grasp the excellent system of ham licensing in Japan. The development of this system is a beautiful story of cooperation between a strong, national radio society and government. This has resulted in 4 classes of tickets (see Table for description).

According to information supplied by the Japan Amateur Radio League, ("Data on Amateur Radio in Japan," JARL, Tokyo) hams there got back into active operation in 1952 (following, of course, World War II). There was a slow increase in the number of licenses until 1958. In this year, two new classes of operator license were introduced to supplement the older, general-privilege type First and Second Classes. These two new licenses allowed the holder to operate with a power under ten watts, and on all bands except 14 MHz. One was a Telephone Class (voice only, no code), and one was a Telegraph Class (code only).

The advantage of these tickets is the fact that they are very simple to obtain. To get a First or Second Class operator license, a prospective amateur must be examined by the State at a selected examining point. Unfortunately, these exams are held only twice per year. The Japanese Ministry of Posts and Telecommunications (comparable to FCC) has, however, sanctioned JARL to conduct radio training courses for the Telephone and Telegraph tickets. By completing

DESCRIPTION OF JAPANESE AMATEUR LICENSES

OPERATOR CLASS	SCOPE	No. of LICENSES (1971)
First Class	Service operation and technical operation of radio equipments of amateur radio station. 500W max. antenna power.	2,998
Second Class	Service operation and technical operation of radio equipments of amateur radio station. 100W max. antenna power.	12,237
Telegraph Class	Service operation and technical operation of radio telegraph of amateur radio station using frequencies above 21 MHz, or below 8 MHz. 10W max. antenna power.	21,253
Telephone Class	Service operation and technical operation of radio telephone of ham radio station using frequencies above 21 MHz, or below 8 MHz. 10W max. antenna power.	232,579
	TOTAL	269,067

one of these courses, a student need only apply to the government for his ticket; no exam is necessary.

These courses are held all over Japan. In 1970, 559 such courses were offered and 31,511 new operators were graduated. The students are taught theory and then send for their ticket, bypassing the painstaking wait for examination.

In Japan, operator licenses are obtained first, and then an operator may apply for a station license. All stations must be approved by a government inspector. The League is, however, authorized to certify station equipment (so long as its power is under ten watts), thus eliminating the need for state inspection, and most certainly a painstaking wait.

Perhaps one of the major flaws of our own licensing system is the long waiting period involved. How often have you heard, "I would like to get a ticket but it takes forever and I just don't have the time?" With these government sanctioned courses, the time is quickly reduced and the road is less rocky.

The Telephone license is not a "CB" type ticket, either. People going through the JARL courses are taught radio theory and operating practice; they don't just buy their way in. Since this ticket requires no code exam, operators who might not wish to use code in their operation need not go through the pains of learning it. Again, the code may be stunting our own ham growth.

Price tags are much lower in Japan, ranging from 50¢ (U.S.) for the ten watt operator tickets to $4.20 for a 500 watt station license. Here it may be noted that the maximum antenna power allowed for a station with a First Class operator is 500 watts.

The rapid growth of ham radio in Japan can be credited to an excellent, well organized national society and a willing government. Hopefully, our own system could benefit from the Japanese ways and grow more quickly, too.

The author is indebted to the Japan Amateur Radio League for their aid in supplying information.

...WB5EBC

Bill Hoisington K1CLL
Farover Farm
Peterborough NH 03458

A SIX METER CONVERTER USING INTERNATIONAL CRYSTAL KITS

The International Crystal Manufacturing Co. is to be congratulated on putting out a series of four little 1½" X 1½" kits with printed circuit boards and all the components needed to make up an excellent six meter converter for a total of only $17.40, including the transistors and the local oscillator crystal.

Included are two rf stages, a mixer, and a crystal-controlled oscillator, each only 1½" X 1½" and 1-1/8" high. These are complete down to the last detail of plug-on connectors; they are furnished and each one of them works like a charm. You can assemble and solder any of them in less than an hour and if you pay attention to the precise instructions they work immediately.

You should hear the stations piling in on the completed converter! Even though I am over 50 miles away from the nearest metropolitan area, I counted over one dozen stations talking busily one night as I tuned over the band, which was just as QRM-free as I could wish.

I'm going to assemble these kits, along with the International oscillator into a complete mobile and battery-portable station.

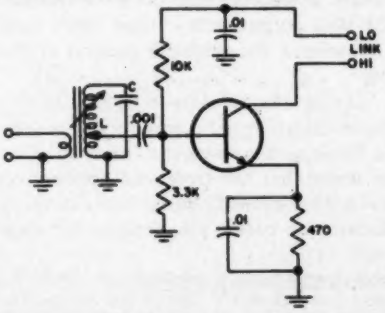

Fig. 1. Schematic of the SAX-1 rf amplifier.

These kits, the two SAX-1 rf amplifiers, the MXX-1 mixer, and the OX oscillator, mounted together in a minibox give you a high-sensitivity six meter converter to put in front of your present receiver.

Don't forget that you're not limited to six. You can order kits and coils for any band between 2.3 and 170 MHz; quite a range. In fact, I'm building a second one for two meters to go into a mobile-battery portable station.

I'm really getting to like these little boards. They do everything that's claimed for them, and look at the prices! A crystal oscillator with the transistor sells, at this writing, for only $2.95, and every last little bolt, nut, and resistor is in that package. You do have to order the crystal separately, but at that price you don't care too much.

The rf Stage

The International SAX-1 kit is a small signal rf amplifier, with the "LO" kit from 3 – 20 MHz and the "HI" kit carrying on up to 150 MHz. It is fine for six meters. The schematic is shown in Fig. 1.

The SAX-1 rf stage went together easily enough; this time I soldered those staked pins right away. When the time comes to test it, one way is through the mixer, so I tackled that kit next. I advise doing the oscillator kit at the same time, then you will have the whole six meter converter to check out.

However, I also tried the SAX-1 kit on the tuned diode receiver for use as an rf amplifier by itself and it showed plenty of gain on six. This gain varied a little with collector tuning, as expected, different lengths of cable used between the rf and mixer stage, or in this test case, to the diode receiver, making a slight increase.

With different voltages and cable lengths I was able to get as much as 40 times gain in power, but I didn't need this much. The noise figure (good in my test) can be set by a nominal 10 dB in the rf stage, which you will get in any case.

The unit handles perfectly and has shown no oscillation at any time. Of course, when I start putting these boards into an enclosure to make a compact front-end converter, some shielding may be needed.

The Mixer

Reading everything in the instruction sheet and checking out the parts, the printed board, and the connections in and out of the board for the rf, the oscillator injection, the dc inputs, and the i-f output, resulted in a good assembly and soldering job in a little over an hour. Like all these kits so far, the mixer worked right away. Figure 2 shows the mixer schematic.

Before I could test the mixer plank I needed another oscillator on 22 MHz to beat with the 50 coming in, to give me an i-f of 28 MHz. It happened that when I started using converters on six and two, my best receiver had a good 10 meter section in it, so most of my converters run with an i-f output of 28 MHz.

In case you wish to operate with a different i-f you can simply order another crystal with your mixer-oscillator kits since the mixer outputs are broad-band. I put in a coil, as shown in one of the possible output circuits in the instruction sheet, since I am

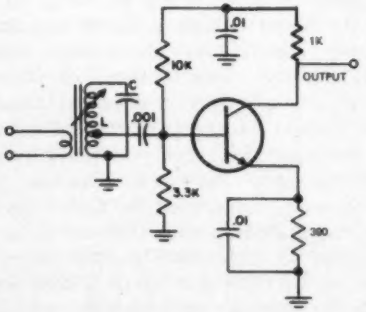

Fig. 2. Schematic of the MXX-1 mixer. Don't forget to use a .001 µF between the output and your receiver.

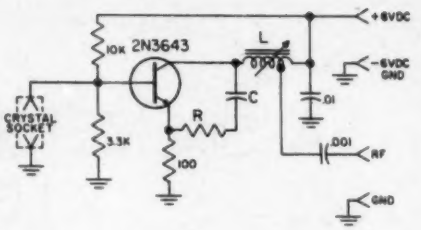

Fig. 3. Schematic of the OX oscillator

partial to tuned mixer outputs. It brought the mixer gain up quite well.

The oscillator is next. Check the section after that for the mixer's tuned circuit output.

The 22 MHz Oscillator

The schematic is shown in Fig. 3.

I was getting to be an "expert" now with International kits. Everything checked out fine, and this one went together as though "factory wired and tested." I got output on 22 MHz as soon as I threw the battery switch. I peaked up the coil correctly with the threaded core slug, which I inserted carefully; it works very tight. This is fine for holding the tuning while mobile, but take the precaution of working the slug back and forth while you're inserting it, the same as with any tapping operation.

All you have left to go for the front end is to connect everything up, watch out for feedback (I didn't find any) through the battery wires back to the input section, and build the tuneable i-f to go with it. I checked it out with my solid state Ameco R5 receiver as a tuneable i-f strip.

The whole converter can be tested out for 28 MHz output with a tuned diode receiver following it for a second method of checking.

Going directly into a sharp-tuning ten meter receiver can be done, but requires care in lining up the converter. After all, it's nice to know that the front end does put out a good 28 – 30 MHz signal you can see on a meter even before you connect the receiver to it.

Tuned Mixer Output Circuit

On page 3 of the mixer instruction sheet are shown several block diagrams featuring

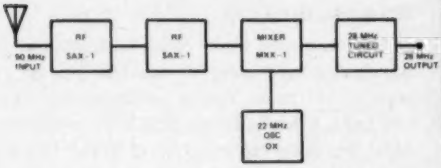

Fig. 4. Block diagram of the six meter converter.

assemblies of mixer and oscillator; and last, the rf stage, mixer, oscillator and receiver. My advice is to use the last mentioned assembly plus the mixer output tuned circuit. This really peaks things up and drops i-f leakage almost out of sight. I-f leakage occurs when you pick up an unwanted signal directly on the i-f frequency with your receiver. The importance of getting rid of i-f leakage is very great. Two things will do this for you. First, plenty of signal from the converter, which simply overrides the leakage signals; secondly, good shielding and inter-unit grounds. Figure 4 shows the complete converter assembly used here.

Your ten meter receiver is now loaded with 28 MHz noise-plus signal. That's good because it swamps out most of the i-f leakage.

The tuned mixer output circuit deserves a word or two more from the point of view of bandwidth adjustment. The signal power it puts into the receiver being used has already been mentioned, and the frequency band over which it does this can be adjusted in width as follows. Figure 5 shows the circuit of this little "peaker-upper." I've always tuned my mixer outputs; a comparison with tuning and without on this converter shows why. Use good shielding and good cables throughout to keep the i-f leakage down.

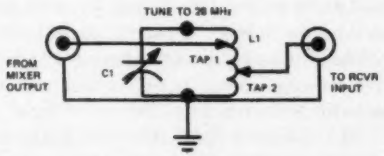

Fig. 5. Tuned circuit used with mixer output stage. L1, 7T no. 18, 5/8 in. dia., 4 TPI; Tap at 3 turns from ground; Tap 2 at 1 turn from ground; C1, ARCO 426, 35 to 275 pF.

All you need are #4 mounting screws . . . just plug-in components . . . like ¼ watt resistors, ceramic capacitors, diodes, I.C.s, transistors and more . . . and your circuit's built! No special patch cords needed! Components interconnected with any solid No. 22-26 gauge wire.

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Tap 1 adjusts the impedance match of the mixer collector on 28 MHz to L1 and tap 2 adjusts the output loading. I used a tap at 3 turns for the collector and a tap at one turn for the receiver. This latter may vary with the receiver used.

Second rf Stage

This one really topped off the whole enterprise. It is my opinion (subject to further checking) that 99% of the possible birdies, the spurious harmonic detection, and the i-f leakage are eliminated with use of this stage. The increased six meter signals now swamp out any unwanted out-of-band signals.

One of these days I'm really going to lash up a "TRF" receiver! Maybe five or six rf stages. Actually two good ones are probably all you need, because by then you have practically eliminated problems of gain, sensitivity, noise, image, and other spurious reception from your design, leaving only the questions of frequency tuning, dial calibration, and selectivity for your i-f section. These are generally taken care of in your communications receiver.

Frequency Correspondence

This worked out very well using one of the OX oscillator kits and plugging in 50, 50.5, 51, and 52 MHz crystals that just happened to be lying around the shack. I checked on the receiver, and sure enough, at 28, 28.5, 29, and 30 MHz there were the signals, converted down from six meters. This of course is the whole idea to get from six meters down to where you can tune it in on a reasonable cost receiver, on ten meters, for example. However, it is nice to see it spread out right in front of you, and, too, this gives you some idea of the in-band frequencies you tune in with your receiver. As I type, I can hear many signals on six, including some SSB on the low end of the band.

When the two meter converter is assembled and wired I'll need a four MHz band on the receiver, but that's where an all-frequency receiver, 0.5 to 54 MHz comes in handy. If you have an amateur band-only job you can use different crystals in the converter to tune over a wider band than is available in such a rig.

Harmonic Detection

This is a very nasty thing to enounter. It has discouraged many an amateur builder as well as old pros. You're tuning nicely over the band when suddenly you come upon the most awful racket you've ever heard. One of your oscillator harmonics, times two, three, or four, from 22 MHz up to 44, 66, and 84 and even higher landed on a TV or FM station. One of those "fifty thousand watts by Authorization of the FCC's jobs." You're using a narrow band AM dectector and these FM signals do not sound nice at all.

They also come in loud on a few inches of wire or components exposed on the bench. The answer is shielding and more rf stages, luckily enough the same cure used for i-f leakage.

Listening on Six With a Complete Converter

I braced up a wide-spaced four element beam only about three feet over the ridge pole and immediately was listening to several lads chatting away. This was noon and mind you, a Wednesday. Rotating the beam and hitting myself on the head for neglecting this band for several years, I heard over a dozen stations in the eastern New England area some 75 miles south of Peterborough NH. A 90% QRM-free band with MHz width!

My main lab receiver is an all solid state job tuning from 0.5 – 54 MHz, as mentioned, for only $89, the Ameco R5. It is doing a good job with this International converter just finished, considering the compromises that must be made in the receiver in order to tune such a range. As well as listening to the first six amateur bands while I write and work it is extremely useful for various things in the lab, such as listening to oscillators you may be building anywhere up to and including 54 MHz. And now of course I'm using it as a tuneable i-f for the International converter on six, and soon for two also.

At 7:30 to 8 A.M. several mobiles were coming in from Sudbury, Wayland and Framingham, MA, to name a few towns heard from 50 airline miles plus. These signals come right over Temple Mountain, a 2000 foot ridge in my backyard.

...K1CLL

J. D. Lamonica XYL W7DXX/1

THE WIFE, THE HAM, AND THE OTHER WOMAN

The wife was happy and so was the groom
At least 'til the end of the honeymoon.
Then, alas and alack! Oh, pity the wife
She discovered another in her husband's life.
When home from work he'd rush through the house
To hear the words from her squawking mouth.
Alone in his shack with her he'll sit
As long as his sleepy eyes will permit.
His meals are prepared on a TV tray
Which the wife sets down, then tiptoes away.
She must not disturb with whisper or sigh
The other woman and her avid guy.
From family gatherings he'll usually abstain
With explanations weak and lame.
Friends and relatives feel put down
When he retreats to his sacred ground.
Many nights on bended knee
The wife thanks heaven for color TV.
Her husband has said: "What I am, I am"
And heaven help her – the nut is a ham.

My husband one day showed me an article in *73* that was reprinted from an Ann Landers column. A wife had written to complain about her husband's interest in ham radio. Ann Landers responded with something to the effect that a woman who could not get her man away from a piece of machinery did not have much imagination. Have I got news for her. Racquel Welch in the nude wouldn't interest my husband when he is engrossed in his conversations with those people who have only call letters and no faces.

Most wives of hams probably fight the eternal triangle of husband, wife, and the radio, but my husband happens to operate a remote on top of a 9000 foot mountain. Whenever he has to check his radio it takes all day, and I am required to sit at home so I can give him test counts. Some of my most frustrating moments have been, when in the middle of a project I could not put down, like changing a baby's diaper, I'd hear a voice saying "Honey, if you copy me now give me a ten count." To ignore him would only mean he'd think he wasn't getting through. That would mean he'd spend more time on the mountain in 15 feet of snow working on something he didn't really have to. Frankly, I'm beginning to live with the idea that "Big Brother" is watching me. My husband's control unit for the remote fits neatly in a closet in our master bedroom. How many other wives have been awakened at 3:00 in the morning by a strange voice asking "Anybody copy through the W7DXX repeater?" A couple of days ago I found him staring at a map of the world. "What are you looking for?:: I asked. "Oh," he said, "I was just refreshing my memory on the exact height and location on Mt. Everest." . . . . . I fainted.

Jacqueline D. Lamonica

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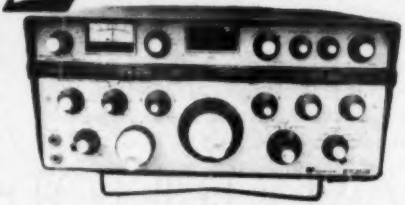

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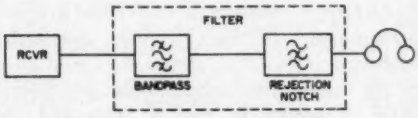

Fig. 1. Block diagram of filter.

section is a very effective tunable notch filter that will tune out any unwanted continuous tone such as a heterodyne. It tunes from 350 to 6000 Hz and its response is shown in Fig. 2B.

Figure 2C shows the overall response of the two sections. The notch can of course be moved in or out of the passband. The resulting hole in the audio response has little effect on speech, and if no heterodyne is present, it can be usefully adjusted to produce some improvement on certain signals.

Details

Figure 3 shows the complete circuit diagram. The bandpass filter is a straightforward type consisting of constant-k low-pass pi and high-pass tee sections. This arrangement uses the least number of inductors and also produces steadily increasing attenuation outside the passband. The tunable notch circuit uses a Wien bridge arrangement. Figure 4A illustrates the basic operation of this circuit. At a frequency given by $f = 1/2\pi CR$ the impedance of the parallel CR combination, let this be Z, is half that of the series CR combination, as shown in Fig. 4B. Since the other resistors are in the same ratio, the bridge is balanced and no signals at this frequency are heard in the headphones. At all other frequencies the bridge is unbalanced and signals are heard. By making resistors R ganged and variable, the bridge can be tuned to reject any desired frequency.

The circuit diagram shows a 1 kΩ

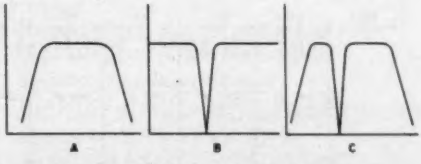

Fig. 2. Bandpass response of filter sections.

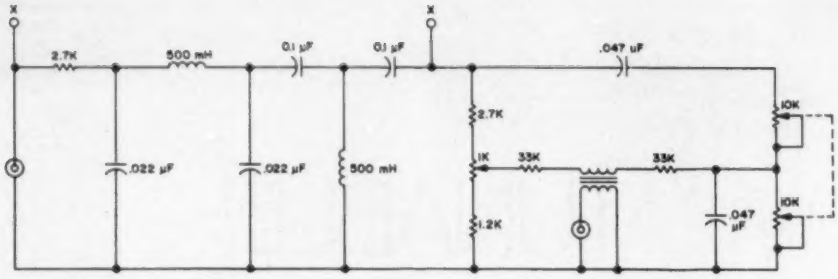

Fig. 3. Filter circuit diagram.

potentiometer. This is a "fine" balance control to allow for differences in the values of the 0.047 μF capacitors and errors in the tracking of the ganged potentiometer. In practice, this control needs little adjustment. The output goes via resistors and a transformer to the headphones. Two resistors are used to balance the winding capacitance of the transformer to ground, which would otherwise lessen the sharpness of the rejection notch.

Construction and Operation

The construction is quite straightforward except that because of the sharp notch an epicyclic drive to the ganged potentiometer is essential. The 1 kΩ potentiometer just needs a small knob. The stray capacitance around the Wien bridge components should be reduced as much as possible and the wiring to the 33 kΩ resistors kept short. The whole unit can be mounted in a minibox.

Before finally screwing the lid down, check that the headphone level is satisfactory. If not, change the value of the 33 kΩ resistors accordingly, keeping them both the same. To get some idea of the effectiveness of this filter, tune in an AM station with the receiver bfo on; then carefully adjust both the controls until the heterodyne disappears.

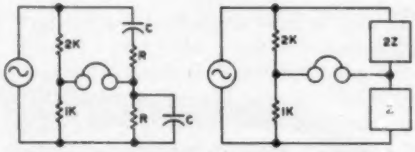

Fig. 4. A&B. Wien bridge arrangement as used in filter.

Alternatives

The classic tunable rejection notch circuit is the parallel tee. However, although it does not need a balancing transformer, it does need a three-ganged potentiometer, and its notch is not quite as sharp as the Wien bridge arrangement. Therefore, I considered the Wien bridge arrangement to be a more practical solution.

An alternative inductorless bandpass filter is shown in Fig. 5. This had a bandwidth of 200–5000 Hz, but the shape is not quite as ideal. It is quite effective, though; and if used, it should be inserted at points X in the circuit of Fig. 3.

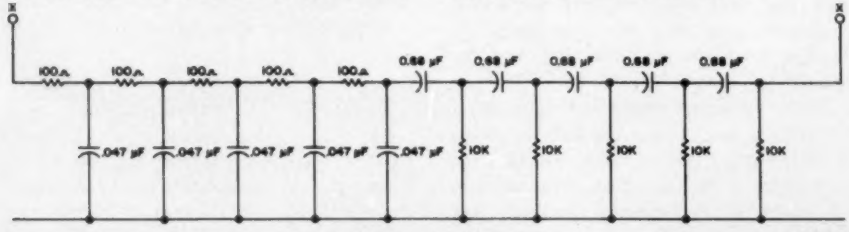

Fig. 5. Alternate bandpass filter.

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SIX BAND LINEAR (AT 5¢ PER WATT)

There is a misconception floating around that homebrew equipment must look that way. To me this is a lot of baloney. I say that homebrew equipment can look as good as you want it to, and I'm sure many builders will go along with me on this. A little time and effort in the construction of homebrew gear can and does pay great dividends in the amount of satisfaction received in operating a rig you built from scratch. Some fellows have never realized this pleasure, and in a way it's a pity. (I had better get off my soapbox and get down to the real purpose of this article.)

In the following pages you will read about a linear amplifier that may convert you from an appliance operator to an avid homebrewer. I'll try to present the material in such a way as to give the inexperienced builder a chance to *become* experienced, and the experienced builder the opportunity to become a even more competent.

The amplifier is basic and complete. I will go over each section and cover it to the best of my ability. The general circuitry of the amplifier is pretty standard and science will not be shaken by any new circuit discoveries. However, the purpose of the article is to present the standard circuit in such a way that we can approach our junk boxes instead of our pocketbooks. By the way, I might mention that the linear cost me $50 complete. This figures out to about 5¢ a watt. Not a bad investment. Although I did quite a bit of scrounging from my junk box and that of my friends, I am certain that the average builder can come pretty close to my price if he has a reasonble junk box or friends with junk boxes, or both. Preferably both.

I hope I have enough of you fired up now, so let's get down to business.

General Layout

Before I go on, I should explain that the linear uses four 811A's in grounded grid and runs at an input of about 1000W PEP. The 811A's are a fairly common tube and no trouble should be encountered in locating a few. The linear is housed in a DX 100 cabinet. This cabinet provides lots of room for the bigger surplus parts I used. The builder may want to cut down on the size for some reason. With a little planning in layout, this can be done.

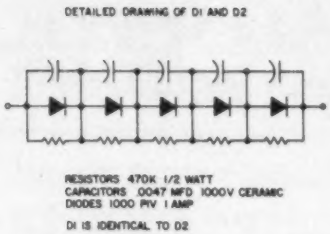

DETAILED DRAWING OF D1 AND D2
RESISTORS 470K 1/2 WATT
CAPACITORS .0047 MFD 1000V CERAMIC
DIODES 1000 PIV 1 AMP
D1 IS IDENTICAL TO D2

Fig. 1. Series diode bank used in the power supply.

The first rule in the homebrewing game is to scrounge a lot. I can't overemphasize this fact. Ask around for a part you need. More times than none you'll find a fellow glad to give away a piece of junk that you are tickled pink to get your hands on. One example of this is the cabinet and chassis I used in the linear. They were both ideal for my purpose and neither cost me a cent. These two pieces of equipment obtained free offer a great savings on the total cost of the linear.

The Power Supply

It is good practice when building to design each section with a higher breakdown rating than will ever be encountered through normal use. By designing something with this in mind, you can be sure that the circuit will probably outlive you.

The diode bank that I used is shown in Fig. 1. The bank is good for 5000V at 1A. Some rating, isn't it? The following is an explanation of why and how I made the diode bank so husky. First, I used a voltage doubling circuit. This meant I needed two diodes at the very least. Because I wanted a rugged diode bank, I used five 1000V 1A diodes in series to form one bank of the doubling circuit. I did the same for the other bank and wound up with a board containing 10 diodes, 10 resistors, and 10 capacitors. The resistors and capacitors are shunted across the diode to prevent harmful spikes that could zap a diode. Some of you may be dubious about using 10 high voltage diodes. Have no fear. The diodes are relatively inexpensive and can be purchased cheaply from Poly Paks. All components are mounted on a phenolic terminal board.

Now that we understand the construction of the diode bank, let's backtrack a little to the ac end of the power supply. The ac cord runs into a preventive device called a brute force filter. The purpose of the filter is to block any rf from backing up through the ac power lines. This is an inexpensive precaution against interference, the number one enemy of ham radio. The coils are made out of #16 enamled wire and wound on a round form about ¼ in. in diamater. They are close wound for about 1½ in. Two of these coils are wound and placed between two terminal strips. The coils are placed in the ac line and any rf is bypassed to ground through the four capacitors. The number of turns of the coil or its diameter are not critical. This flexibility of the construction adds to the filter's simplicity.

From the filter, the ac passes through a fuse and a switch on its way to the transformers. I used two different transformers for the following reason: Each filament of the 811A'S draws 4A. Since we are using four of them, we have a total current drain of 16A. Since most power transformers do not carry that heavy a 6V winding, I scrounged up a surplus transformer rated at 20A. Not only was it perfect for the 811A's, but it was free (another example of scrounging). The other transformer I used was an old TV-type that can be dug up by anyone taking the time.

As stated before, the power is routed through a switch. I used two switches, one for the filaments and the fan, the other for high voltage. The ac switch allows current to flow through the primary of the filament transformer while none flows through the high voltage transformer. By throwing the high voltage switch, the current is routed through the primary of the high voltage transformer. This is a safe way to turn the B+ on and off while the filaments stay lit. As an added precaution, it can be seen in the schematic that the high voltage will not be turned on unless the filament switch is thrown. This prevents high voltage from being applied to a cold tube.

To get the high voltage I needed out of a 900V transformer meant I had to use a circuit that boosted the voltage up. This is why I used a full-wave voltage doubler. I have already explained the diode bank, so

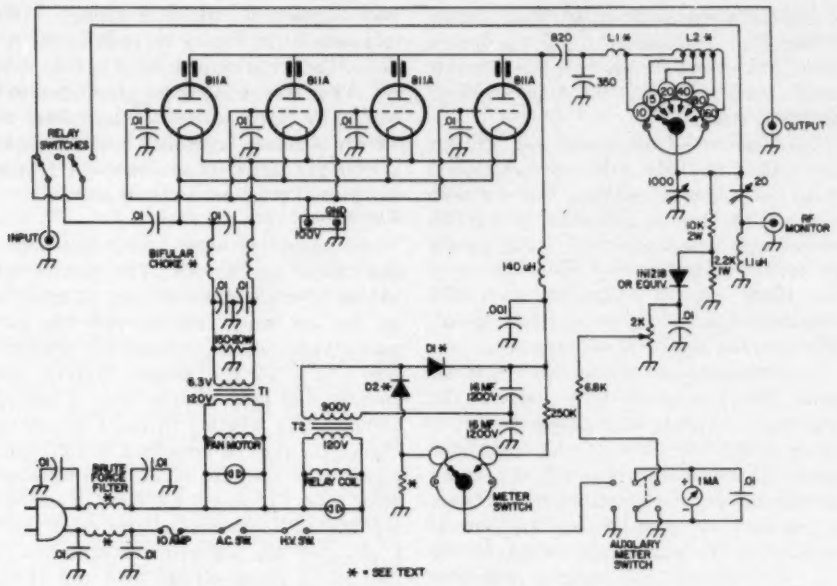


Fig. 2. Schematic diagram of the linear amplifier and power supply.

now I will explain the filtering action. The outout of the diode bank is fed to two surplus oil capacitors. These are located on the extreme right end of the chassis. These capacitors are rated at 1200V with 16 μF capacity. By placing the two capacitors in series I had a safe breakdown rating for the filter.

The filtered no-load dc output of the supply is about 2200V. During operation the voltage drops down to about 1400V. The reason for this big drop is the size of the capacitors. If the builder wishes, higher capacity computer-grade capacitors could be installed and a little better regulation would be realized. I might mention that the oils have worked well for me and they should continue that way for a long time.

It must be remembered that the ac lines in your circuit are going to carry the current of the entire unit. Use the proper wire. Don't try to get by with a smaller size; it will work for a while, but you want something that will work forever. Another word of caution – *lethal voltages exist in your power supply*. Use your God-given brains at all times. You won't be given a second chance.

After you finish the power supply, you have almost half the linear done. Now you can move on to the rf circuits.

The Input Circuit

I'll begin the explanation of the input circuit with a description of the bifilar choke. The choke is wound on a ferrite core measuring about 5½ in. in length and about ½ in. in diameter. Although I feel that the choke is larger than would be needed, it works out well. You may want to refer to the September 1967 issue of *73* for a detailed description and explanation of designing bifilar chokes. This article will tell you how to figure what length of coil you will need. I suggest that it be read thoroughly before the construction of the choke. The windings are made of #12 wire. Remember that the full 16A in the filament line are flowing through this wire. All I can say is, the heavier the better. Two equal lenghs of wire are cut and wound side by side around the ferrite. If you did a good job and used heavy enough wire, the windings will cling to the ferrite and you will have one solid unit that could be used in a battleship.

One last word on the choke. Don't bother buying one. You can do it for less than a dollar, and if you already have a ferrite core lying around, you can do it for nothing. Besides, it's fun.

Looking at the schematic, you will see that I have a 150Ω 20W resistor shunted across the filament winding. You will also see that the tap is grounded. I did this because the transformer that I dug up did not have a centertap. So I figured the next best thing was to make my own. The grounded slider serves as a return point. Without it the linear will not function.

You will notice on the schematic that the input first goes to a relay switch. The purpose of the relay is to enable the operator to switch the linear in and out of the circuit. This device comes in handy, and I recommend that it be installed in this linear for reasons of convenience. The relay is activated by the high voltage switch. In this way, the operator can transmit with low power while the filaments are heating up and instantly have high power by flipping the high voltage switch. A word should be mentioned here about the relay itself. Since the relay (DPDT) will be on as long as the high voltage is on, you must use a continuous duty relay. The relay contacts must also be heavy duty. The relay I used cost me about $4.50 and had contacts rated at 12A. Although I bought this relay new, you may be able to find one in your junk box and thus knock five bucks off the total cost of the linear. The operation of the relay is as follows: The input rf is fed to the middle arm of the relay. With the high voltage off, the power is fed directly to the output jack. When the relay is activated, the input rf is fed to the filaments and the output jack is connected to the linear's tank circuit. Instant power.

Although the grid circuit is technically not a part of the input circuit, I'll explain it here. Each grid lead is bypassed for rf by a .01 capacitor. The leads are also bound together at a central point and run to one screw terminal located on the rear of the linear. The other terminal is grounded. When in use, a jumper is connected between the two screws, thus grounding the grids. However, when the linear is idling, −100V (available off the back of most exciters) is fed to the grids, making them cut the tubes off. Thus during idling no great amount of current is being drawn by the tubes. The −100V is usually controlled by a relay in the exciter and this relay automatically grounds the grids of the tubes during transmit.

The Tubes

As stated previously, the tubes used in this linear are 811A's. The builder may choose to use a different type of tube that he has on hand. This is well and good providing he takes everything into consideration – such as the power supply, input circuits, and tank circuits. Since I was not certain as to whether or not I would ever change the type of tube used in the linear, I constructed the tube layout in a somewhat novel way. I took a 5 x 8 sheet of steel and mounted all four tubes symmetrically on it. I mounted the choke in the center of the four tubes, giving me one solid unit of four tubes. I then cut a 5 x 8 hole in the chassis and had a place to mount the tube plate. The tube plate lies flat against the chassis and it is barely noticeable that the tubes are mounted on the plate. The purpose of mounting the tubes in this manner is simple. Suppose I want to run two 572B's instead of my 811A's. All I have to do is make a separate plate and pop it in the old hole. It makes for easy modification because the rest of the linear can remain the same. This little feature can prevent a great headache for the ham who likes to experiment with different tubes. The tubes are placed a reasonable distance apart, as common sense dictates.

Although I could probably get away without cooling the tubes, I feel the little extra effort is worth the dollars saved in extra tube life. I used a cheap but effective ac fan for the cooling action. This fan is activated when the filaments are turned on. The fan, although small, circulates the air around the tubes just enough to prolong tube lfe. The fan is mounted on an angle and the main stream of air flows toward the center of the tubes. The fan is quiet and one must really listen for it in order to hear it. I paid a dollar for the fan I used. There are many available on the surplus market for about that price.

The leads from the plate caps are brought together at the top of the rf choke. This choke acts as a terminal point for the leads. The leads are covered with ferrite beads for the purpose of parasitic suppression. The beads provided me with better results than could be obtained with the old coil-resistor combination. The B+ line is bypassed for rf by a .001 3 KV ceramic capacitor which is mounted at the extreme bottom of the rf choke. From here, I used Beldon #7766 high-voltage wire for the connection between the choke and the power supply.

The Tank Circuit

I incorporated a conventional PI network in the tank circuit. The B+ is blocked by a 820 μF 20 KV doorknob capacitor mounted just before the tuning capacitor. The value of this capacitor is not critical, but the voltage rating must be high. From this capacitor the rf is fed to the tuning capacitor. The capacitor I used was a Johnson 154-2-98. The capacity of the unit is approximately 350 pF. I obtained the capacitor surplus for about $5. Again if the builder can dig one up he can save himself another five bucks. The output capacitor was one I had found in the shack, and heaven knows where it came from. It is a three section job with all the sections paralleled to give me about 1000 pF of capacity.

The 10 meter coil (L_1) is made from copper tubing. The coil consists of three turns wound on a 2 in. diameter form. The form is of course removed after the coil is wound. L_2 is made from two pieces of coil stock that I found in a friend's junk box. The coils were soldered together and a sheet of Lucite was cemented across the diameter to make a solid coil 3 in. long and about 4 in. diameter. This Lucite provides extra support as well as a means of mounting the coil. The coil is mounted upright for the purpose of space saving.

The rf switch must be heavy duty to withstand the rf voltages present in the tank circuit. The switch I used came out of an old army TU-7-B tuning unit. I purchased the unit for about $3. So far the only thing I used out of it is the switch, but there are many goodies inside worth saving.

Many of you may be asking the natural question of where to tap the coil for each band. The answer is simple. Beg, borrow, or steal a grid dip meter with a reasonable accuracy. Start with 10 meters and work down. Adjust the input and output capacitors so that they are half meshed. Insert the grid dip coil into L_1 and tap down on the coil until a dip is noticed. You now have 10 meters set. Now move to 15 and so forth all the way to 160. The taps are brought out to the switch. It should be mentioned here that the GDO should be set to the middle of the band being tuned.

Since the only effective way of knowing whether or not you are flat topping is to see it on a scope, I incorporated a scope monitoring circuit. The circuit forms a capacitance divider network to which the vertical deflection plates of an oscilloscope may be connected. By increasing the capacitance of the 20 pF variable, you effectively increase the level of signal going to the oscilloscope. The circuit is very handy for monitoring purposes.

Metering

In my linear I have one meter perform three different duties for me. It reads plate voltage, plate current and relative output. Looking at the schematic, you may wonder why I used two meter switches. I had a small wafer switch available in my junk box. The switch contained four contacts. Since it was very possible with this switch to make contact with two points simultaneously, I thought it necessary to space the current and voltage positions one contact apart. This left me no room for the relative output position. I then installed a toggle switch which either connects the meter to the regular meter switch or to the rf monitoring circuit. All this circuit does is sample a little rf by rectifying it and feeding it to the meter. The 2K pot is used as a sensitivity control and is mounted on the front panel to the left of the meter. The circuit is useful during tuneup as an output indicator.

A detailed explanation of how to determine meter shunts and series resistances is given in most handbooks. They will provide you with all you need to know about meter circuits and should be consulted before any attempt is made to design your meter circuit.

The Final Touches

Up to this point you've had it pretty easy. Whatever mistakes you made will not be noticed from the outside. Now you are faced with the tricky and delicate part. Your main objective is to make your homebrew equipment look professional. The outside of the linear is what is going to strike people's eyes. It is from appearance that most people draw opinions.

Let's start with the basic front panel. First, remove the front panel so as to make it easier to work with. Give it a good washing and roughen the surface a little with fine sandpaper. The reason for roughing it is to give the paint a better surface to adhere to. Once you have it cleaned and roughened, apply the first coat of primer. I find that paint in a spray can allows for a neater job. Let the first coat dry thoroughly before applying the second coat. You can get by with two coats of primer, but if you want to play it safe, a third coat should be applied. After letting the undercoating dry for a day, apply the first coat of finish. The color is your own choice, but dark gray looks great. Allow it to dry and apply a few more coats. Now you have a clean, neat looking panel to work with.

The next step is to apply the lettering for the equipment. Before you start lettering, make sure you know what you want and where you want it. After the decals are dry, you have little chance to change your mind. Once you know where everything goes, your next step is to square things off. Draw guide lines in pencil to help get the decals straight. The lines can be easily rubbed off when the decals are dry. Don't skip this step of squaring because you'll be sorry in the end. After you have the lines drawn you can begin setting the decals. Find the term you need and cut it out as close to the lettering as possible. After you have the decal on the panel, adjust it so the letters are even with the guide lines. Continue applying decals until finished.

Stand back now and take a look at the panel. You'll be surprised at what a good job you have done. A word of advice: Practice before you perform the real McCoy. Practice will allow you to get the feeling of the decals.

Operating

Operating this linear can be considered a pleasure. If you have tuned other linears in your ham career you will have no trouble with this one. If this is your first linear, then the following explanation is for you.

As I said before, the best device that can be used in the tuning of the linear is an oscilloscope. I won't go into a description of proper scope patterns, because this is a subject well covered in many handbooks. If you can't possibly obtain an oscilloscope, the next best device is to use common sense. Remember that by over-driving you are flat topping and creating a mess on our bands. The driving power for the four 811A's is about 100W. I drive my linear with an exciter that has an output of about 60W. I do not have to worry about over-driving, but the fellow with the higher power exciter does. If it is not possible to lower the power of your exciter to 100W, then it will be necessary to build an attenuator. These are also discussed in handbooks. Once you have the proper drive, you can tune up the linear just like you tuned up your first novice rig. Start with having the loading capacitor plates fully meshed. Now set your meter to read relative output and adjust the tuning capacitor for maximum output. Continue doing this until key down current is about 600 mA. Remember not to keep the key down for too long a time. You can now switch to whatever mode suits you and have fun. Keep in mind that you should not exceed the dissipation rating of the tubes for too long a period. Treat them well and they'll reward you with long service.

Conclusion

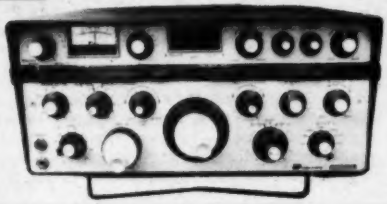
Although I described the linear the way I built it, the industrious homebrewer can and should deviate from the circuit. At any rate, it can be seen that the linear can be built cheaply by using all the surplus parts you can get your hands on. Remember the name of the game – scrounge!

I'll be happy to try to answer any questions on problems that pop up. If you have a problem, do not hesitate to contact me.

...WA9JMY

73 RIG OF THE MONTH SPONSOR

signal/one



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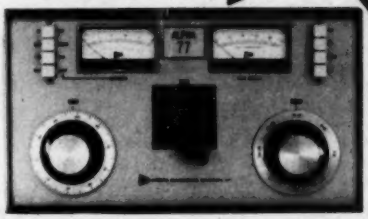

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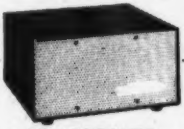
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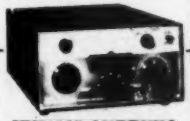
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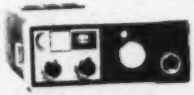
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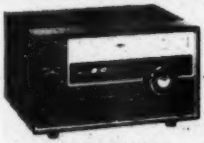
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CURRENT GAIN IN HIGH POWER NPN SILICON XSTRS

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P.O. Box 6032
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Clemson SC 29631

While trying to design a high current power supply regulator, I found that suitable transistors available to the experimenter are few. And these transistors are not cheap; two of the three selected sold for more than $6. Current gain is definitely expensive in more ways than one, as this article exposes.

But more important – of those available, the betas given were either in a range or as a typical value. The disparity was just too great. Having close at hand the facilities to measure accurately transistor current gain, I decided to measure them myself. This short article is a report of my findings.

Beta is Not a Transistor "Constant"

The results are presented in three forms: a table of beta values versus collector current, a picture of an actual curve trace, and the graph of the averaged beta values for each type of transistor versus collector current. All were obtained (directly or indirectly) from a Tektronix 576 curve tracer and all illustrate the same main point; current gain decreases with increasing collector current.

Each representation does have its own specific advantage. The table will also give you some idea of the individual performance you can expect from these readily available transistors. The values given are for h_{fe}; H_{fe} would be larger as seen from the trace. (h_{fe} is small signal current gain; H_{fe} is steady state current gain.) The curve trace shows you how I measured the beta and also allows you to determine the H_{fe} of SK3036 sample number 3. You could expect similar results with other transistors. The graph allows you to easily "see" the beta decrease (and how fast it decreases) as the collector current increases. I do not remember them ever mentioning in school that this would happen!

Conclusion

The point to remember is this: the manufacturer's specifications are probably not applicable to your specific application. If possible, measure the parameters of your

TABLE I
BETA VERSUS COLLECTOR CURRENT

Type	HEP 704		SK3036			HEP S7000		
Typical h_{fe}	90		100			70		
Sample #	1	2	1	2	3	1	2	3
I_c	BETA (h_{fe})							
15 Amps	4	2	8	12	9	11	11	9
12	8	4	12	12	12	16	14	12
10	8	6	14	14	14	20	19	20
8	10	8	18	22	20	22.5	22.5	22
7	18	12	21	20	25	25	25	22
5	22.5	17.5	30	32.5	38	40	35	38
3	40	25	45	55	60	55	45	50
2	56	44	60	72	90	76	58	64
1	90	70	85	105	125	115	70	78
0.5	125	100	100	110	150	115	93	85

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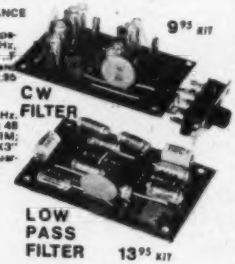

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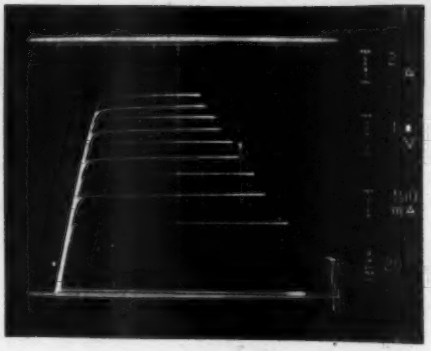

Fig. 1. Curve trace of RCA SK3036 transistor, sample #3.

specific transistor; if not, use the most accurate data you can find.

Obviously I could have extended my observations to other transistors and/or parameters. This is indeed a worthwhile project, but I shall leave it to someone more industrious than I.

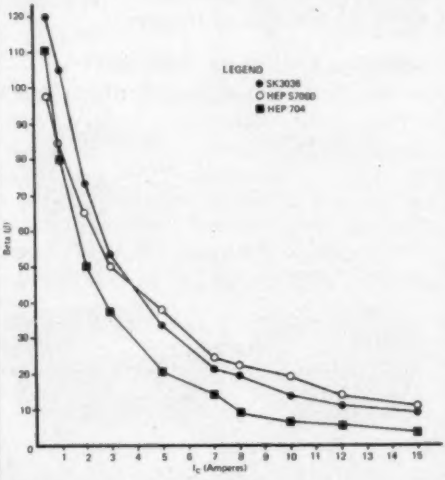

Fig. 2. Averaged beta values versus collector current for all 3 types of transistors.

Acknowledgements

I would like to thank the Department of Electrical and Computer Engineering, Clemson University, and in particular Dr. Lewis T. Fitch W4VRV, without whose help this project could not have been completed.

. . .WB4LVA

Bill Hoisington K1CLL
Far Over Farm
Peterborough NH 03458

IC TEN METER TUNER FOR USE WITH SOLID STATE VHF-UHF CONVERTERS

This ten meter front end is highly suitable for use following crystal-controlled converters from six meters up to the 1296 MHz band, or higher. Its mixer output is on 1.65 MHz which places the image 3.3 MHz away, where it is many dB down.

I will describe in detail the design method and circuit of a ten meter tuner using the Motorola HEP590 IC (integrated circuit) in the rf stage for high gain, high selectivity, and no feedback. Also used are the Miller 3-gang miniature variable capacitor and the Miller two-speed dial for proper coverage and easy tuning of the frequencies between 28 and 30 MHz.

As we went through the rf stage, its use as a ten meter preamp by itself proved so excellent that this is also described as a bonus, and will prove to be a very useful piece of equipment at times.

The use of the Motorola HEP590 IC results in high gain, high selectivity by virtue of the loose coupling between stages and tuning elements, and negligible feedback in the rf stage. The reduction of image is thus considerably enhanced over that obtainable with a single transistor.

As a ten meter preamp it adds an almost unbelievable pull-in power to a low cost or old receiver on ten.

Available coil forms and coils are also used, which makes it easier getting components together for construction.

Last but not least, the unit is packaged and ganged using a tracking method which does not consist of just connecting three coils to three sections of a gang capacitor and hoping for the best. With the method described you *will* get proper tracking and be sure of it.

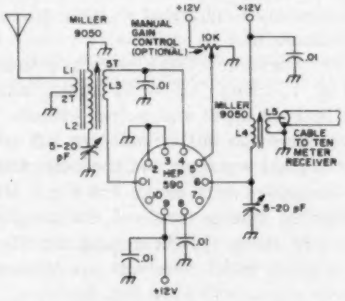

Fig. 1. Pre-amplifier circuit diagram. If manual gain control is not desired, leave pin 5 on ground for maximum gain. Pretty simple, eh?

The result is a battery-operated unit which in conjunction with an i-f system and a VHF or UHF converter, will furnish you with a mobile, portable, or emergency receiver having extreme selectivity and sensitivity, and cut you loose from dependence on your big 50 lb communication receiver and ac power.

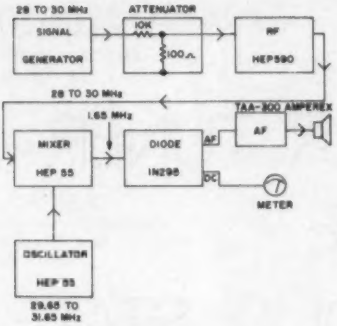

Fig. 2. Setup for coil alignment.

The Motorola IC HEP590 as a ten meter preamp showed its high gain and practically non-existent feedback. To be exact, even with high Q coils in the input and output circuits it has never oscillated even once in use so far, from 135 kHz up to 50 MHz. Having battled with transistor feedback and neutralization for some years, this is really something. The 590 even handles better, tuning much like an old fashioned tube receiver input with symmetrical tuning instead of the unsymmetrical tuning as with the usual transistor rf stage without neutralization.

The schematic of the preamp is shown in Fig. 1, using the Miller subminiature coils in both input and output circuits. In this preamp the 9050 coils are left with their original windings and the extra windings are added over them. For the 2 MHz bandspread tuning range of the complete front end using the three gang capacitor, the original 9050 windings are removed entirely as you will see in Fig. 3.

This preamp, however, gave such a jolt to the present ten meter band on my lab receiver that I thought it best to describe it for you as a separate item. Once again, it features absence of feedback and has never oscillated once, in spite of all kinds of changes and tuning up for ganged operation.

Input to the 590

See Fig. 2, block diagram, and Fig. 3, overall schematic. Table 1 gives you an idea of how to line up an input circuit for ganging use when a tuning range of only 2 MHz is desired with a given capacitor that has a 5–20 pF capacitance range. The block diagram, Fig. 2, shows the coil test setup that enables you to do this with ease and confidence.

As is the case with all the $30 signal generators that I've so far encountered, the attenuator on mine is nothing to write home about, and not enough shielding can be used for the money to do much good at 28 MHz, but you can make up an external uncompensated attenuator that will do the trick for you. This little 100 to 1 box with its 10K in series and the 100Ω in shunt is included in Fig. 2. Of course, attenuators of this sort are really perfect only at dc, but you'll be surprised at what it can do for you at 28 MHz just the same. It *does* give you relative power reduction and that's what you need here. With the signal generator gain about 3/4 on, plug the attenuator box into the "high" output jack and there will be a reasonable output from the HEP590 which will give about a volt or so of dc out of the diode, as in Figs. 2 and 4. The test diode is clipped onto the mixer coil as shown in Fig. 4, and there is of course not much selectivity, but that's not what you're after here. You want relative gain as in Table 2 and relative tuning range with a section of the three-gang tuning capacitor, and this test circuit gives it to you in easy style. Be very sure that nothing is being overloaded as this will falsify your tests. The dc voltage out of the diode should rise to 4 or 5V when pushing the input (do *not* do so) and drop to zero when the coils are detuned. Incidentally, if you plug an antenna into the input you can hear those Texas kilowatts on ten, and up on

Turns on L2, Fig. 3	Relative Volts out	Total Tuning Capacitance
8	2.1	30
7	2.1	35
6	2.1	40
5	2.1	50
4	2.1	70
2	2	85
1½	1.4	110
1	N.G.	N.G.

Table 1. Relative gain vs turns on L2.

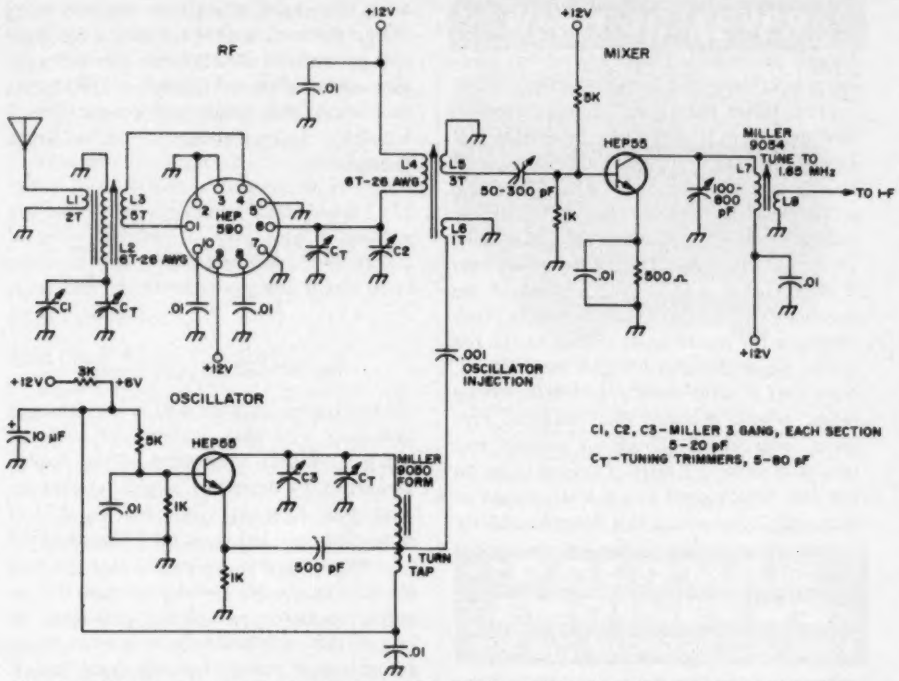

Fig. 3. Ten meter tuner circuit diagram. The Miller 9050 and 9054 should be used if at all possible. They are ideally suited to this project because they are easy to modify and fully magnetically and electrostatically shielded. They are available through most large catalogs or directly from J.W. Miller Co., P.O. Box 5825, Compton CA 90224. For those who cannot get these coils, the 9050 varies from 1.5 to 3.0 µH and the 9054 ranges from 28.0 to 60 µH. Also, the triple ganged capacitor used is non-critical. Do some experimenting until you get something with a maximum capacity of about 11 pF per section.

the 11 meter broadcast band in the morning South Africa, London and others boom in very loud.

Note that this is *without* any i-f at all so far.

Meanwhile, back at Table 2, referring to Fig. 3, you can see at a glance the relation between the number of turns on L4 and the tuning range. This subject is of great importance in making a ganged job and is taken up in further detail in the next section. Proper tuning is always important for selectivity, which also reduces image, and especially for a three-gang capacitor tracking unit, which is difficult enough without putting odd bends in the tracking curves. If you think it's a lot of work to take a three-winding coil in and out of a circuit 8 times to add or subtract one turn each time, you're so right! But it's worth it. I've left the whole front end alone near 29 MHz for several days now and just tune over a 100 kHz or so with the lab receiver on 1.65 MHz as an i-f and G's, W7's, ZS and UC stations have been on the air most of the time. It's really stable and good, even in breadboard form.

Table 1 shows the relation between the number of turns and the gain, or conversion efficiency of the converter. Only when you cut down to less than 4 turns does the gain begin to drop. This allows you to pick the tuning range you want, still using the 5 to 20 pF section of the Miller three-gang job as is.

2 MHz Dial Spread

This ten meter front end, while very interesting on ten, is primarily designed for use as a tunable converter and i-f unit

between a crystal-controlled VHF or UHF converter and a fixed tuned i-f. This latter should be a double-frequency job for maximum selectivity and image rejection.

The Miller three-gang tuning capacitor, part no. 1460, is such a nice little item that I never had the heart to remove plates on it to cut down the tuning range. There also seems to be a big advantage in the heavy external capacitor padding used in parallel to spread the 3-gang tuning to a little over 2 MHz. Table 2 shows the relation of the number of turns on L2 to the tuning range obtained for the rf input circuit in the ten meter band. Refer to Fig. 1 and Fig. 3. Note that 8 turns gives over 4 MHz tuning range, which is more than wanted. Five turns, plus about 30 pF of parallel pad results in some 2.5 MHz of tuning range on the dial, which gives you a little margin at each end. You can cut this down to exactly 2 MHz if you wish, Table 2 showing that only 4 turns for L2 gives you *less* than 2 MHz of range.

For calibration, a 28 MHz crystal oscil-

Turns on L4, Fig. 3	Relative Output Volts	Tuning Range With 5–20 pF
8	2.3	More than 4
7	2.3	More than 3
6	2.4	About 3
5	2.4	2.5
4	2.3	1.5 MHz

Table 2. Tuning range vs turns on L4 of Fig. 3.

lator can spot 50, 144, and 432 on the dial for you. For example, with a 50.5 MHz rock, doubling several times to 404 MHz as a local oscillator in the 432 receiver, the 28 MHz point on ten and the 432 point on 432 came out on about the same black line, which is plenty good enough. If you want this unit to serve on 6, from 50 to 52 MHz, or on 432, it works fine with its 2 MHz spread. If you are on 2 you may want to cover 146 to 148 MHz as well as 144 to 146, and then you will have to switch crystals in the 2-meter converter. Or build a second one of these jobs that covers 4 MHz spread on the dial. The second one will be easier than the first!

On 432 at present you only need a few hundred kHz spread, but this may change with the years. Right now the 432 band seems to be rock-ribbed, but if a lot more lads get on with all-solid-state rigs and want the continuation of QRM-free QSO's that now exist, they might get to need vfo's. I wouldn't worry about it for a while though.

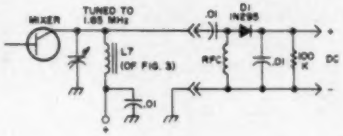

Fig. 4. Diode test plank circuit.

The tuning on even 432 is very smooth and easy with this system, and with the sharp 3–4 kHz bandwidth of the double frequency i-f described, it still remains so. And this is what you need on 432. I remember my first work on 432 with sharp i-f, when turning on or off the kitchen stove three floors below detuned the receiver oscillator out of the passband. Of course that was using those old-fashioned things called tubes! I don't deny that if you're on the car battery and turn headlights on and off, that this won't happen then also with this unit.

Lining Up

Once the combination of L, Cpad, the Cv (variable) has been determined for the bandspread desired to put 2 MHz over 90% of the dial, the business of setting up the mixer and oscillator proceeded. Each Miller 9050 coil form was stripped of its original winding and wound with the number of turns as in Fig. 3 and its coil table, and carefully tested, still using the setup of Fig. 2, the block diagram. With everything falling into line nicely, a preponderance of one turn coupling links could be seen, indicating good match and energy transfer, as well as a smooth frequency curve vs. 3-gang capacitor shaft rotation.

The oscillator took most of the time to line up, but once the main points were found, the rest was easy. The emitter tap works well at one turn from the low end of the oscillator collector coil and the mixer injection voltage is best when taken off the same tap, thus eliminating the need for a

third winding on the oscillator coil. A 3K resistor can also be seen in the plus lead to the oscillator, because the conversion efficiency of the mixer likes it that way, with 5–6V only on the oscillator. This also cuts down oscillator harmonics.

The tuning range of the mixer input inductance, which is also the rf (IC 590) collector coil, is shown in Table 2. The number of turns for best gain is also the same, as you can see in Table 1, which is partly the result of design and partly good luck, I'll admit.

Lask Check Before Ganging

What a pleasure after the tuneup battle! Each of the three circuits, rf, mixer, and oscillator, are now exactly as they will be in the packaged minibox version, each one lively, sharp tuning, with the 5–20 pF of the gang job tuning just over 2 mHz, in parallel with some 60 pF of padding, each dial marked with (temporarily) "28" and "30" MHz. So far not a trace of spurious or birdies anywhere. That heavy parallel capacity really does a job on harmonics. There apparently is quite a benefit with solid state devices in using low-impedance circuits, highly padded and loaded with C.

On The Air

As usual, when I check on ten, the first station heard was an African, CR6JTT, in Angola, Portuguese West Africa. It was 7:30 AM, EST, which might be the reason. ZS6DAL was next. What a time for DX! These lads are just beginning to come through and are still calling CQ! Others heard were UP2KNC, UC5DF, YO6ALD (where in the world is that?), and Uncle Charlie 2KNU. Looking back to my own "best time" on ten, I find it was 1947, which by a strange coincidence turns out to be almost an exact number of two sunspot cycles. I ran a pair of 4-250's and a rotary 16-element beam. If this keeps up I'll find myself on ten again!

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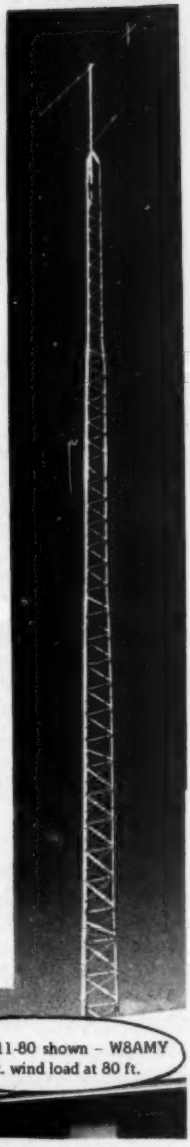

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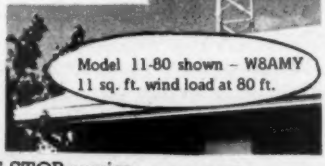

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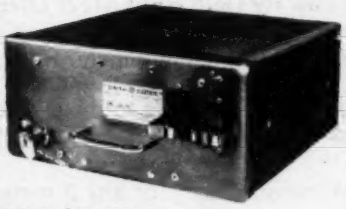

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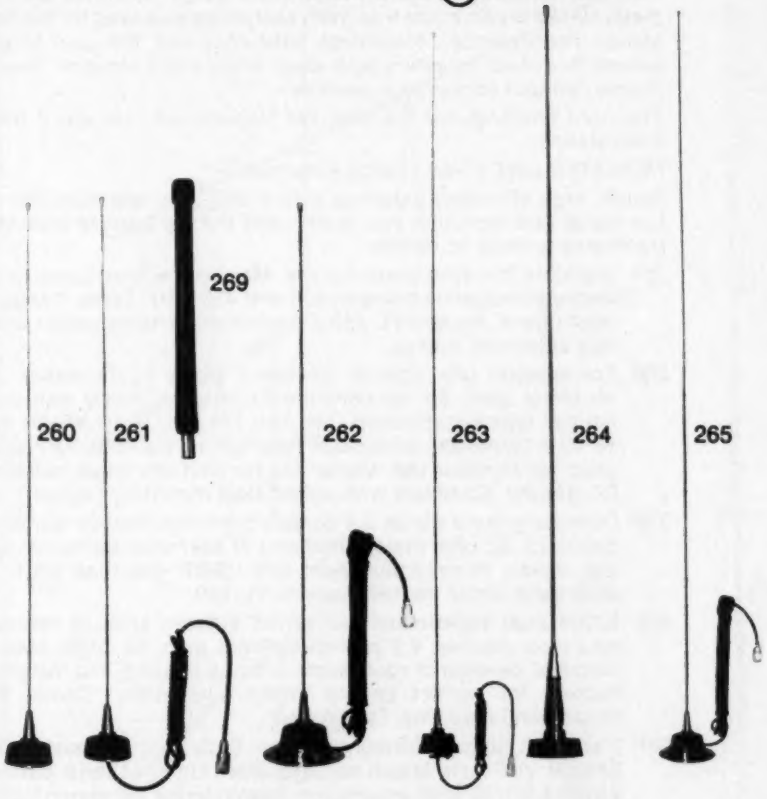

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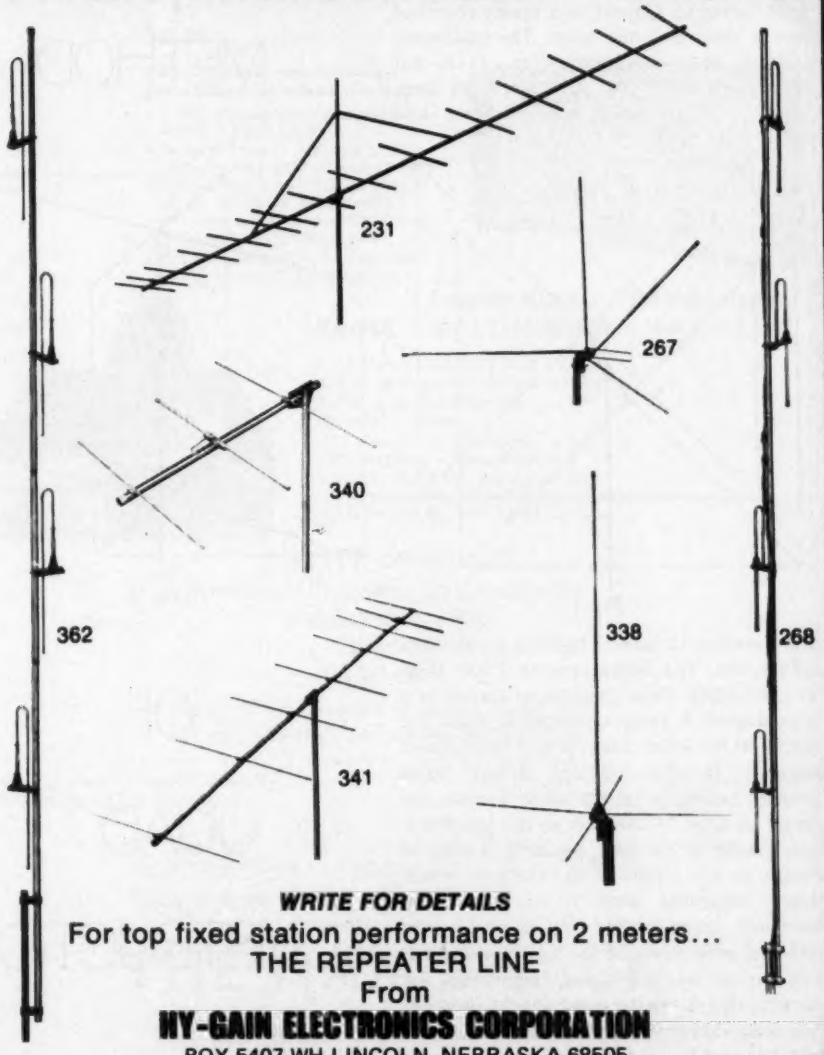

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The mechanical structure of the cubical quad serves to support two square forms of wire a short distance apart. The traditional method of construction (Fig. 1) is not particularly efficient, particularly as large torques are impressed on the boom and mast, leading to lack of rigidity, mechanical failure, etc. The design presented here (Fig. 2) overcomes these deleterious forces to a large degree. A quick examination shows the merits of the latter. First, it uses less support material, thereby reducing weight, wind loading, and stress on the mast. Second, the center of mass of each side of the antenna is much closer to the mast, resulting in reduced torque in the center of the antenna, which might otherwise cause it to break. The electrical specifications are in every way identical with those of the traditional quad, and any of one's preferred techniques for constructing a regular quad can be used for this one, except of course for the fact that metal cannot be used for the arms.

. . .WB2HYW

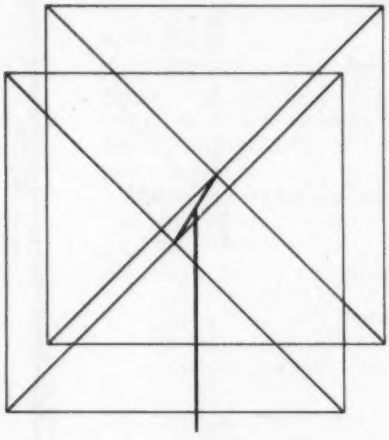

Fig. 1.

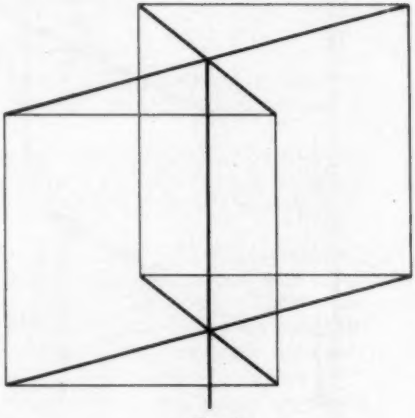

Fig. 2.

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IMPROVING THE DRAKE R4A RECEIVER

The Drake R4A receiver is an excellent piece of equipment as it is, but a few minutes with a soldering iron will give even better operational performance.

The modifications that follow will not affect the resale value of the unit at all and no realignment or instruments are needed. Before you start be sure you have located the right parts; these parts can be changed or added without touching anything else.

In early production runs of the R4A the resistors R41 and R89 were respectively 470Ω and 270Ω. These resistors are in the S-meter circuit and control the activity of the S-meter. Apparently performance could be improved and some changes were made. R41 was changed to 560Ω and R89 was changed to 470Ω. After that there still seemed to be room for more improvement and changes were made by Drake once more; R41 was changed to 820Ω and R89 was changed to 560Ω. However, the last change could cause the S-meter zero pot (R42) to run out of range. The final modification is as follows: change R41 to 820Ω and change R89 to 620Ω.

I mention all the resistance values in case your R4A has different values yes, R41 and R89 are under the chassis on one of the small circuit boards. The numerical designation of the 2 resistors in the R4A diagram has not been changed and a good look will show what is what.

The above modification will make the S-meter performance much better and more realistic, and the following modification, my own, will improve the performance and output of the crystal calibrator.

As it is the output of the crystal calibrator does not give much (if any) indication on the higher bands; on 10 meters it is very weak, certainly no indication of any signal can be seen with the early S-meter circuits. A simple diode will bring it up 3 to 5 S-meter units on the higher bands. Connect in series with C118 (1½ pF) and between C118 and the antenna input jack a 1N34A diode. Lifting C118 from the antenna jack and soldering the diode in series will do it. Just make sure the cathode of the 1N34A is connected to C118 and the anode to the antenna jack; if they are connected incorrectly no or only slight improvement will be noted. No cross modulation effects were observed, since with the calibrator switched off the diode is, for all practical purposes, out of the antenna circuit.

...V36TW

M. B. Crowley EI4R
78 Church Street
Listowel
County Kerry
Ireland

ANOTHER HEDGE CLIPPER

That detector and AGC system you read about in *73 Magazine* has just been installed. You switch on and sit back. The signals pour forth loud and clear. Just then the XYL switches on the vacuum cleaner. The AGC meter goes wild and nothing but grating noises issue from the loudspeaker. You are left with nothing but regrets that you left out the noise limiter as you hurriedly reach for the reference books, only to find such a complexity of limiters that you start tearing what remains of your hair in despair. But hold it! Save that precious commodity on top.

What you need is a noise limiter that is simple, effective, easy to install and will work effectively with any receiver.

Let's take a look at our noisy signal just after detection. The noise clings fairly and squarely on top of both the negative and positive half pulses of audio signal. A circuit is then required which will conduct sufficiently to allow that precious signal through, but will not conduct to the noise riding on top of the audio signals. This circuit must also perform this function on both the negative and positive half cycles of the required signal.

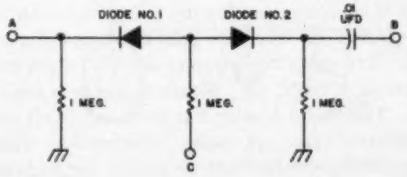

Fig. 1. Crystal diode noise limiter circuit.

A well known tube circuit which performs these functions is the Dickert noise limiter. However, I had no incliniation to fit yet another tube to an already crowded receiver chassis, and decided to try the circuit with crystal diodes. The circuit eventually evolved as shown in Fig. 1.

The positive voltage, applied through the 1 MΩ resistor to the junction of the two diodes, will hold the diodes in a conductive state. The positive voltage is of such a value that the maximum peak of the audio signal will not reach a value in excess of the positive gating voltage, and will thus pass through to the next amplifier stage.

Now let's see what happens to that large noise pulse riding in on the positive half cycle of our audio signal. On the positive half cycle, the noise pulse will be greater positively than the gate voltage. Therefore, the junction of the diodes is negative with respect to the detector side of the diode, resulting in the No. 1 diode ceasing to conduct; thus blocking the noise pulse.

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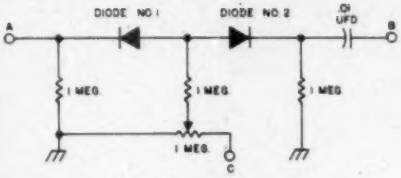

Fig. 2. Addition of 1 MΩ potentiometer to allow the gating voltage to be varied.

On the negative half cycle, the reverse holds true, and then No. 1 diode will pass through the noise pulse. The negative pulse voltage will cancel out the gating positive voltage and thus block No. 2 diode during the duration of the noise pulse. In effect, therefore, the noise pulses riding in on our audio signals are blocked off, both negatively and positively, and our audio rides through. All this with 2 diodes, 1 condenser and 3 resistors. Diodes with a reasonably high back resistance are quite suitable. The higher the back resistance the better the noise limiting action.

I take my positive gating voltage from the cathode of the audio output tube, which reads some 5V. The voltage available from this point may not be a suitable value for gating in other receiver types. A recommended addition would then be a 1 MΩ potentiometer to allow the gating voltage to be varied, and connected as shown in Fig. 2. Again the user may wish to use a negative gating voltage. In this case just reverse the two diodes.

I have thought of using the negative gating voltage, as taken from the AGC line. Provided the AGC voltage is of sufficient value to allow the gating effect, this is quite feasible and our system then becomes signal following.

To insert in the circuit, disconnect the lead from the audio side of the blocking condenser from the detector circuit. Point A is then connected to this blocking condenser, and our free wire goes to point B. Point C then goes to our positive (or negative) gating voltage, to whichever supply is used.

This noise limiter has been tried out on various types of noise interference with gratifying results and is now a permanent fixture in the receiver.

. . .EI4R

J. W. Herbert ZL2BDB
3. C. Cumberland Grove
Porirua East, New Zealand

DESIGN FOR AN IMPROVED AGC SYTEM FOR CW AND SSB RECEPTION

A receiver capable of employing full agc facilities under all modes of reception is essential for comfortable listening on the amateur and shortwave bands. Many receivers however, employ only a simple agc system that falls short of providing an acceptable performance, particularly when reception of CW and SSB signals is required. Although some excellent papers have been written on the subject of improved agc systems, most of them involve relatively complex circuitry and are designed to be incorporated as a part of a sophisticated receiver design. I, like many other hams, found the need for an agc system giving acceptable performance under all modes of reception that could readily be incorporated in homebrew receivers and transceivers. The system must, however, be uncomplicated by additional agc amplifiers, "hang" gates and multiple controls. To meet this end the circuit to be described was developed; but first some background theory may be in order to show why the conventional simple agc system is inadequate for code and sideband reception.

Figure 1 shows a simple agc system of the type in general use in the less expensive commercial receivers. While this system may give acceptable results on AM signals, it is unsuited to CW and SSB reception because the attack time for the circuit is too slow. For amateur purposes, the attack time of an agc system may be defined as the time taken for the voltage on the agc rail to reach 63% of the maximum value it will attain upon receiving a steady incoming signal. This may be recognized as the familiar "charge" time constant for a resistor-capacitor combination. Similarly, the decay time for an agc circuit may be regarded as the time taken for the agc rail voltage to drop down to 37% of its maximum value after the incoming signal ceases.

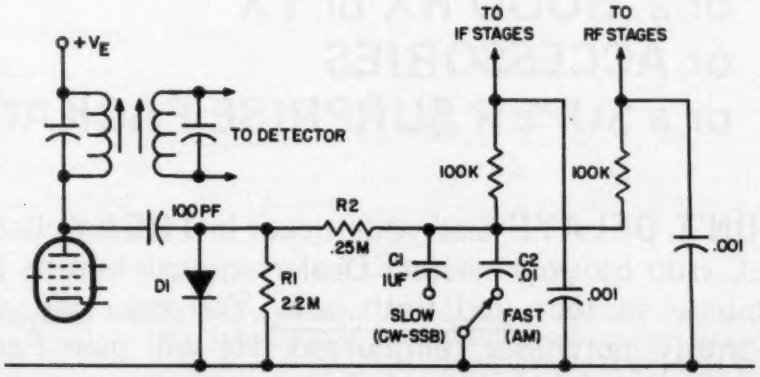

Fig. 1. Typical simple agc system.

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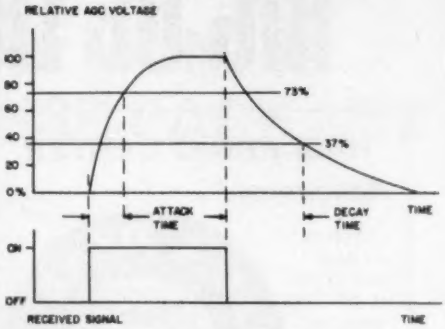

Fig. 2. Relationship between signal level and attack and decay characteristics of an agc system.

These attack and decay times are illustrated in Fig. 2.

When receiving an AM signal, the carrier is present to regulate the receiver gain and the response time of the agc system need only be fast enough to follow signal fading. An attack and decay time of about .15 second is typical for AM reception.

Under CW and SSB conditions, no continuous carrier is present to regulate the receiver gain and if the attack time is too long, an appreciable amount of speech or code may be received before sufficient agc voltage is developed to regulate the receiver gain. This results in an unpleasant "thump" at the beginning of words or code characters. To overcome this effect an attack time of less than .01 second (10 milliseconds) is generally considered the maximum permis-

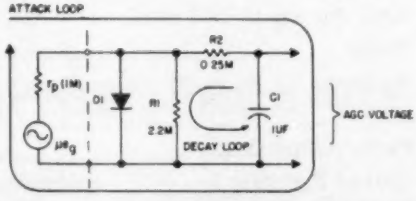

Fig. 3. Calculation of attack and decay characteristics for a simple agc system using an equivalent circuit. Attack time: Refer attack loop. T (seconds) = C (μF) x R (M) where C = C1 = 1 μF and R = Rp + R2 = 1.0M + .25M = 1,25M ∴ T = 1 x 1.25 = 1.25 seconds. Decay time: Refer decay loop. T (seconds) =. C (μF) x R (M) where C = C1 = 1 μF and R = R1 and R2 = 2.2M + .25M = 2.65M ∴ T = 1 x 2.45 = 2.45 seconds.

sible for satisfactory results. It is also important that the agc voltage does not fall away too fast between words or code characters, otherwise a peculiar "gasping" effect becomes apparent. A decay time of not less than 1 second will be satisfactory in overcoming this "gasping" effect.

It is common practice to switch a larger value of C in parallel with the agc filter (as shown in Fig. 1) to achieve two rates of decay, one for AM, the other for CW-SSB.

To evaluate the performance of the simple agc system generally, Fig. 1 can be redrawn in the form of an equivalent circuit as shown in Fig. 3.

It can be shown that a valve amplifier may be represented as a voltage generator in series with a resistance that is equal to the internal impedance of the valve. Such representation is known as the "Thevenin equivalent circuit" and is employed in Fig. 3, wherein rp is the internal resistance of the i-f amplifier that feeds the received signal into the agc rectifier circuit. The important feature to note here is that the valve represents a series resistance (rp) whose effect must be taken into account when evaluating the operation of the agc circuit. For a pentode amplifier rp has a typical value of .25 – 1M. By substituting typical values for the circuit components it is easy to assess the charge and discharge loop circuits and hence determine the attack and decay times for this simple agc system as shown in Fig. 3.

It can be seen immediately that the simple agc system falls short of the maximum acceptable attack time of .01 second. The slow attack time can be attributed to the large amount of series resistance in the agc charging path and is made up of the high internal resistance of the i-f amplifier stage and the agc filter resistors. The agc filter resistor (R2) can be replaced by a diode which "gates" the agc rectified voltage into the agc rail thus eliminating its .25M resistance from the circuit as shown in Fig. 4. However the high internal impedance of the i-f amplifier still severely limits the attack time.

An Improved Agc system

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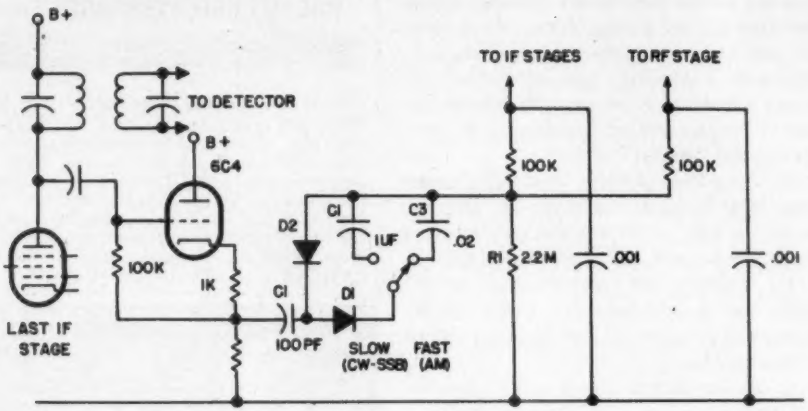

Fig. 4. Circuit for an improved agc system.

reduced. The simplest solution to the problem is to insert a cathode follower between the i-f amplifier and the agc rectifier as shown in Fig. 4. The cathode follower is characterized by a low output impedance and as illustrated in Fig. 5., the output impedance of the cathode follower is approximately 500Ω. Since there is little change in the voltage gain through the cathode follower stage, component values may once again be substituted in the equivalent circuit and re-evaluation of the performance made as shown in Fig. 5.

This evaluation shows that this agc system is characterized by attack and decay times very acceptable for CW and SSB transmissions. Various decay times can be readily achieved by changing the value of C2. The actual value required for C2 to obtain a required decay time in this circuit is easily calculated using the following formula: C (μF)= 2.2/decay time in seconds.

Several values of C2 can be switched to achieve fast, medium, and slow decay characteristics.

In addition this improved agc system offers other circuit advantages:

(1) The cathode follower has a negligible loading effect on the last i-f transformer and hence does not cause any deterioration of selectivity.

(2) Because of the negligible loading effect on the i-f amplifier, greater gain is possible.

(3) The series diode gate in the rail actually doubles the agc voltage available from the cathode follower. This may be recognized as the half wave voltage doubler circuit wherein the voltage developed across C1 on the plus ve half wave cycle is added in series to that developed across C2 on the minus ve half wave cycle. Thus, although no true amplifier is used, the system exhibits increased control due to this voltage doubling action.

This improved agc system is capable of excellent results on both AM and SSB/CW signals and has proved to be a very successful modification to existing receivers that formerly suffered from poor agc characteristics when receiving CW and SSB transmissions.

. . .ZL2BDB

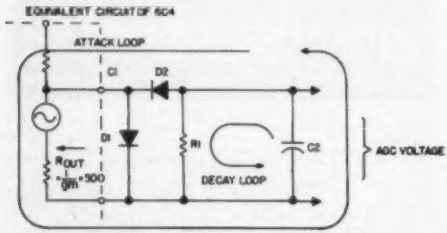

Fig. 5. Calculation of attack and decay characteristics for the improved agc system using an equivalent circuit. Attack time: Refer attack loop. T (seconds) = C (μF) x R (M) where C = C2 = 1 μF and R = R out = 500Ω = .005M ∴ T = 1 x .005 = .005 seconds = .5 millisecond. Decay time: Refer decay loop. T (seconds) = C (μF) x R (M) where C = C2 = 1 μF and R = R1 = 2.2M ∴ T = 1 x 2.2 = 2.2 seconds.

William P. Turner WAØABI
5 Chestnut Court
Saint Peters MO 63376

A GALLON AND A HALF IN A GALLON BUCKET

Any number of articles have been written on the subject of using TV transformers in high voltage supplies. The usual method is to voltage double the entire HV winding and disregard all other windings in order to reduce the load on the transformer and thereby minimize heating of the core. This arrangement works well as evidenced by the number of these supplies in everyday use.

This article will deal with a method of dissipating the heat generated by the transformer, thus allowing greater current to be drawn from a given transformer without danger of catastrophic failure.

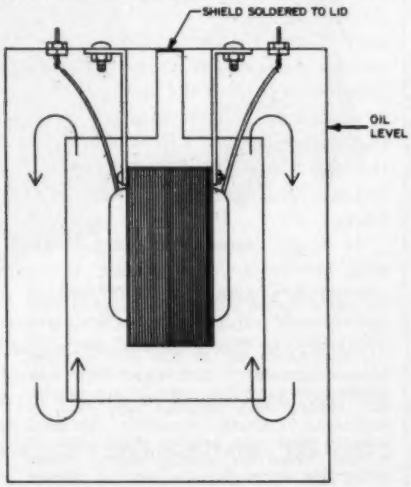

Fig. 1.

Taking a page from the Heath Cantenna, a gallon bucket was procured as the starting point. The transformer was stripped of its end bells and unused windings to improve heat transfer. Angle brackets were then attached to each side of the core at one end for mounting purposes. A fruit juice can was modified to form a shield clearing the core by ¼ in. or so. 1½ in. tabs were cut in the top of the can and the end ¼ in. bent to a 90° angle in order to space the main portion of the can about 1¼ in. from the mounting surface. Do not decrease this dimension, it provides room for the hot oil to expand.

The transformer is mounted in the center of the lid of the bucket by means of screws running through the lid and the previously mentioned brackets. The tabs of the shield are soldered to the underside of the lid after it is aligned with the transformer. The primary and secondary leads are brought out through feedthrough bushings.

Select a square of medium to heavy sheet metal the same size as the diameter of the bucket and after drilling a hole in each corner, silver solder or epoxy it to the bottom of the bucket. This will serve as a base for mounting purposes. Clean the entire assembly and paint the outside flat black. Fill with transformer oil to ¼ in.

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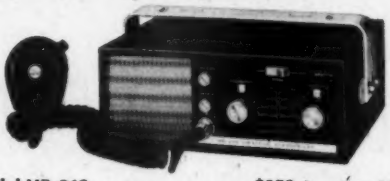

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above the top of the shield with the transformer in place. This will require a slight bit of quesswork. Transformer oil is often available from the local power company in small quantities and at a very reasonable price.

As the transformer heats up, the oil directly in contact with the windings becomes warm and rises to the surface within the shield only to be replaced by cooler oil from the bottom of the bucket. The hot oil is cooled by contact with the outside of the bucket, which acts as a heatsink. By the time it reaches the bottom again the oil is much cooler and is ready to absorb more heat.

It is my conservative estimate that in SSB service a 50% increase in output current is available without running the transformer at elevated temperatures. There is some loss in output voltage due to the resistance of the secondary winding, but this loss is small in relation to the increased current available. I have run 1400W PEP using this arrangement without difficulty.

. . . WAØABI

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THE HW22A-MORE VERSATILITY

Every owner of a Heath HE22 or HW22A can continue to enjoy full phone band coverage with this modification that permits operation in the new 7.150 to 7.200 MHz sub-band recently allocated by the FCC.

It can be safely assumed that the HW22A single bander from Heath and its equally popular sisters the 12A and 32A are in use by the thousands on 40, 75, and 20 respectively.

Let us consider for the present the HW22 and 22A 40 meter unit. This transceiver tunes 7.2 to 7.3 MHz and a very fine job it does. With the recent FCC decision to enlarge the phone bands, the owners of these little rigs are out in left field, so to speak.

Here is one simple answer. L6, the vfo coil, is padded with a 47 pF disc capacitor, designated C-205. If the ground end of C-205 is opened by a small switch, the rig now tunes 7.125 to 7.240 MHz which covers the new SSB frequencies. No retuning is necessary except to peak the final tune control.

The switch may be soldered directly to the ground lug for L6 and C205 and the lead from C205 will reach it, no holes to bore, no wires to change, and the rig can be returned to stock condition for trade or resale in about 30 seconds flat.

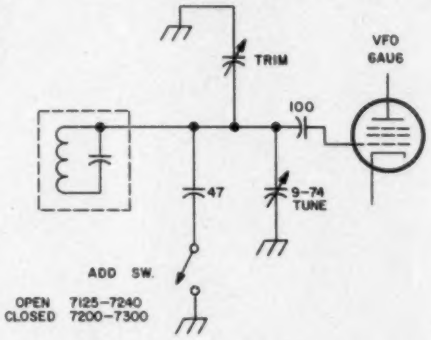

Fig. 1. Circuit showing the addition of a switch to shift the HW22A oscillator frequency.

As an added feature one can key V5 cathode and work a little CW for a change of pace.

This little change works out nicely on the HW22A as it is now in use, and no doubt the same thing can be done with the other two single-banders. By the way, the switch can be operated by a wire brought up through the top of the case. Stiff piano wire works fine.

...K7JVZ

Fig. 2. New calibration scheme after modification.

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Joe Burnett W3GHZ/0
9410 Fir Drive
Thornton CO 80229

HAL ID-1 MODIFICATION

When our repeater group decided to add a CW identifier, we ordered a model ID-1 from HAL Devices. After it was received, our technical staff put it through a series of tests. We discovered that its operation wasn't quite what we'd had in mind. It identified on call-up, but was not designed to identify again unless another repeater call-up occurred after a "guard" period of 22 or more seconds following the first call-up. With the identifier timer set for the three minute interval, the next ID then occurred 2 minutes 50 seconds after the first ID. This sequence was not suitable for a "rag-chew" machine with a five minute timer, so we decided to modify the ID-1. This would disable the 22 second "guard" feature to allow identification at each call-up, and then identify again 2 minutes 50 seconds later if the repeater was still in use. We felt that no identification was necessary when the repeater was not transmitting. The modification would be engineered so as to make maximum use of existing components with a minimum of circuit changes.

ID-1 Circuit Operation

An examination of the circuit diagram of the ID-1 reveals that the unit actually consists of two sections: a timer section and an identifier section. In order to actuate the identifier section, a call-up input must have been received, and the timer must have cycled through. While the identification is occurring, the timing circuit is inhibited. After the identification is complete, the ID section sends a RUN signal to the timer section to allow it to operate again. The "guard" feature is the result of the timer section setting a flip-flop at the end of 22 seconds. Since this flip-flop is designed to clear when a call-up input is received, it must be set before the input can make it clear. Any input during this "guard" period will be ignored. The purpose of clearing the flip-flop is to provide a toggle signal to the next flip-flop to establish a partial enable for another CW identification. The identification will occur after the timer cycles

Modification

We decided to modify the ID-1 to allow the identifier section to be actuated independently of the timer, but to allow the timer to cycle while the repeater was in use. By cycling the timer, an identification could be made to occur 2 minutes 50 seconds after the initial identification, provided the timer was started from zero at each call-up. To start the timer from zero, it must be reset after each use. This is done by applying a signal to the "CLEAR" inputs of the flip-flops which make up the timer section.

Since the ID-1 is on a printed circuit board, the actual modification requires some care. Probably the best way to do it is to open the "runs" between components and install wires to the new points. The runs can be opened with a sharp instrument such as a knife point. It is not necessary to remove the entire run, just to open it at some point. The new connections are made with lengths of small hook-up wire. Additionally, two "OR" gates must be constructed and installed adjacent to the circuit board. Each gate is made up of two diodes and a resistor, and

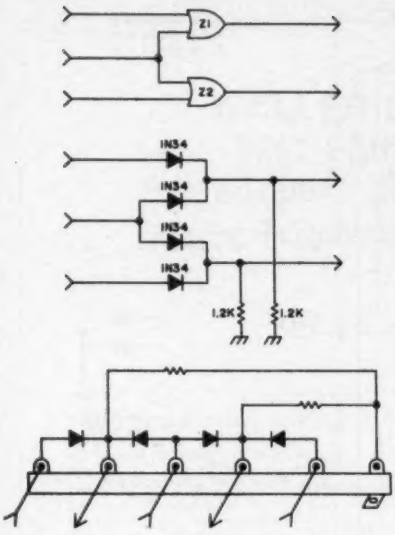

Fig. 1. HAL ID-1 Modification – OR gates.

both gates can be mounted on a single terminal strip (see Fig. 1).

The "runs" to be opened are: to IC #4, pins 2 & 3; to IC #8, pins 2 & 3 (pins 6 & 7 must still go to ground); to IC #11, pin 5; to IC #13, pins 9 and 12; to IC #14, pins 5 & 9; IC #14, pin 2 to pin 3; to IC #15, pins 2 & 3; to IC #16, pins 2 & 3.

Hook-up wire connections:

"OR" gate Z2 – output to IC #11, pin 5; single input to IC #13, pin 12; Z1 and Z2 common input to IC #13, pin 9.

Connect the "run" that previously went to IC #14 pin 9 to IC #14 pin 8.

Connect a jumper from IC #14 pin 8 to IC #14 pin 2.

Connect a jumper from IC #14 pin 5 to IC #16, pin 12.

"OR" gate Z1 – output to IC #4, pins 2 & 3; single input to IC #14, pin 9.

Also connect IC #14 pin 9 to: IC #8, pins 2 & 3 (pins 6 & 7 still to ground); IC #15, pins 2 & 3; and IC #16, pins 2 & 3.

Remove the .001 μF capacitor from the ACTIVATE input line, and replace it with a 47Ω resistor.

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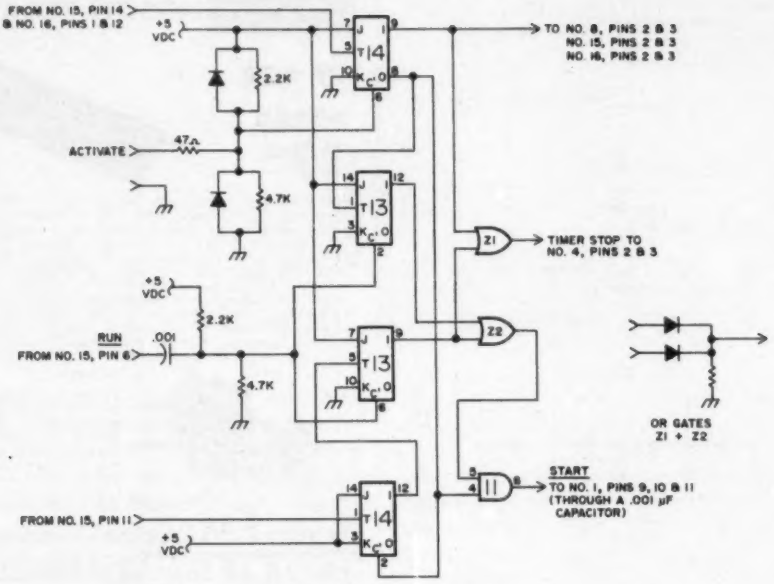

Fig. 2. HAL ID-1 modification.

Conditions: IC #13 pin 9 high; IC #13 pin 12 low; IC #14 pin 8 low; IC #14 pin 9 high; IC #14 pin 12 low.

The high from IC #14 pin 9 has reset the timer to zero. At repeater call-up, IC #14 pin 8 goes high, and pin 9 goes low. IC #11, pins 4 and 5 are now both high, causing a low to be felt at IC #11 pin 6, starting the identification. The high from IC #14 pin 8 is also felt at IC #14 pin 2, which releases the flip-flop for operation when a toggle signal is received. The timer is still inhibited through "OR" gate Z1 because of IC #13 pin 9 being high. At the end of the identification, the RUN signal goes low, clearing both flip-flops on IC #13. This releases the timer and inhibits the input to IC #11 pin 5. If the call-up was short (such as if someone keyed up the repeater to hear the identifier), the ACTIVATE line has gone high because the input is no longer present. Approximately three seconds after the RUN signal goes low, IC #14 pin 5 receives a toggle signal from IC #16 pin 12. This makes IC #14 pin 9 go high, stopping the timer. When IC #14 pin 9 goes high, pin 8 goes low, and IC #13 pin 1 receives a toggle signal. This causes IC #13 pin 12 to go high, preparing IC #11 to respond to the next ACTIVATE input, and resetting IC #4 to zero through "OR" gate Z1.

If the repeater call-up results in the use of the repeater, the ACTIVATE line will remain low, holding IC #14 pin 8 high and pin 9 low, allowing the timer to cycle. One minute 25 seconds after the ID at call-up, IC #14 pin 12 goes high as a result of the toggle signal from IC #15 pin 11. If the repeater is still in use 2 minutes 50 seconds after the initial ID, IC #14 pin 12 goes low again because of a second toggle from IC #15 pin 11. This provides a toggle signal to IC #13 pin 5, making IC #13 pin 9 high and causing a second identification to occur. The flip-flops in IC #13 are then reset by the RUN signal, preparing the ID-1 for another CW identification after 2 minutes 50 seconds.

This modification has been described in some detail in the hope that other repeater groups might benefit from the work of the WØJGL repeater technical staff. When you come to Denver, bring a set of crystals for 07/67 with you. Ours is an open machine, and we welcome visitors. We may not be number one yet, but we're trying harder!

. . .W3GHZ/Ø

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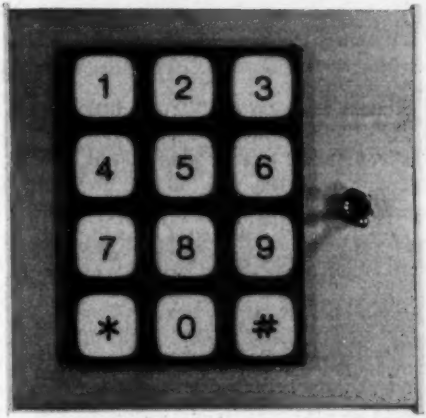

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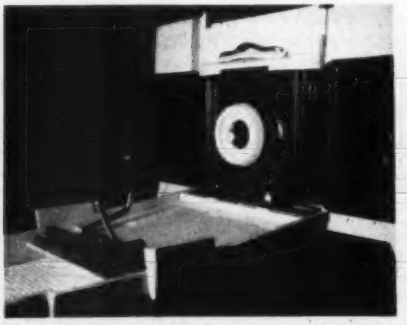
POLAROID PRINT COPIER FOR SSTV

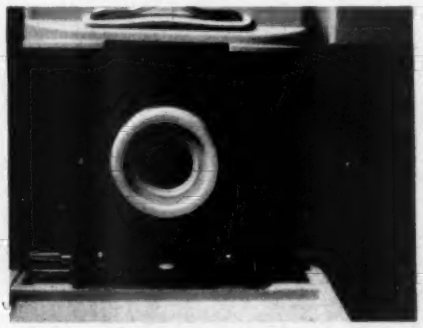
Having been on SSTV for a little over one year now and using the Robot SSTV equipment I have found that at times I desired a quick way to write calls, focus on pictures, etc., without having to use the magnetic letters that I have. I wanted something that I could insert a small card or picture in and then focus the Robot camera on for transmission of pictures. Such a device would have its own light source so that external lighting would not be required and it would also have its own lens so that close-up lens for the Robot camera would not be required.

Before going to the drawing board and work bench to build such a device, I decided to look around the shack to see if I had anything I could modify that would meet my requirements. For several years I have had a Polaroid Print Copier, Model 230, which was used with the old Model 80 Polaroid cameras to make copies of Polaroid prints. The copier has its own light source and its own lens. The only problem that I could see with using the copier as it was originally designed was that it had a large door (see photo) that must be removed in order that the Robot camera could be placed close to the copier to focus the Robot camera on the picture or writing that I wanted to be transmitted.

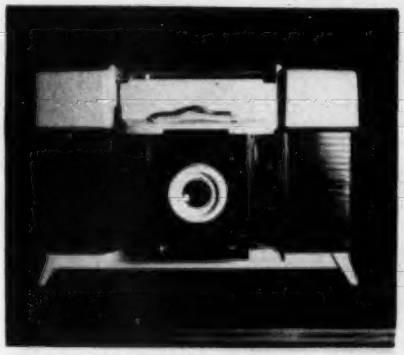
It is a simple matter to remove the door, which also has the lens attached to it. All that is required is the removal of the two nuts that hold the lens frame to the door and the removal of the pin that hinges the



Polaroid Print Copier before modification showing the door that must be removed before copier can be used for SSTV. Notice the 2 nuts just below the lens – these are to be removed along with the pin that holds copier door to the body.



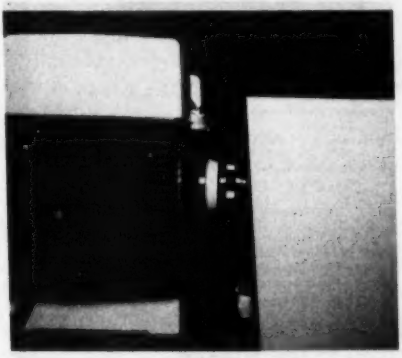
Close-up of Polaroid Print Copier showing lens, the 2 nuts that must be removed, and door hinge (pin must be removed).



Polaroid Print Copier after door was removed. Notice the two nuts on lens door – these are removed – merely shown here to indicate the ones that were removed. Lens door is glued back in place.

door to the body of the Polaroid Copier. With this done, you will now find it necessary to put the lens back, but this time without the door. Put a small amount of glue around the lens frame and place back on the Copier. The Polaroid Copier is now ready to be used with SSTV.

To use the Robot SSTV camera with the Model 230 Polaroid Copier first set the Robot lens to infinity and place the lens of the camera to the lens of the Copier as shown. Place a picture or small card in the Copier, turn on the light in the Copier, adjust lens opening of the Robot camera for the amount of light needed, and you are ready to transmit SSTV pictures. Some



Robot SSTV camera and Polaroid Print Copier being used to transmit SSTV pictures.

Picture made using the Polaroid Print Copier for SSTV.

experimenting will be required to see just how much writing can be used and the size of the picture that you can use, but this can be determined without much difficulty.

Picture that was used to make transmit picture using copier. Notice that in previous photograph only the head was actually transmitted.

As for acquiring one of the Polaroid Print Copiers – Model 230 – it should not be too difficult. The copiers cannot be used with the newer Polaroid cameras, and this particular model was designed to be used with the Model 80 Polaroid camera. It is my understanding that there are not many of the Model 80 cameras being used as it is rather hard to acquire films. The original cost of the Model 230 copier was about $29.95. It is suggested that if one of the copiers is desired that you contact some of the large photographic dealers.

. . . K4PRT

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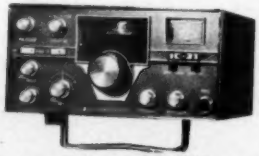

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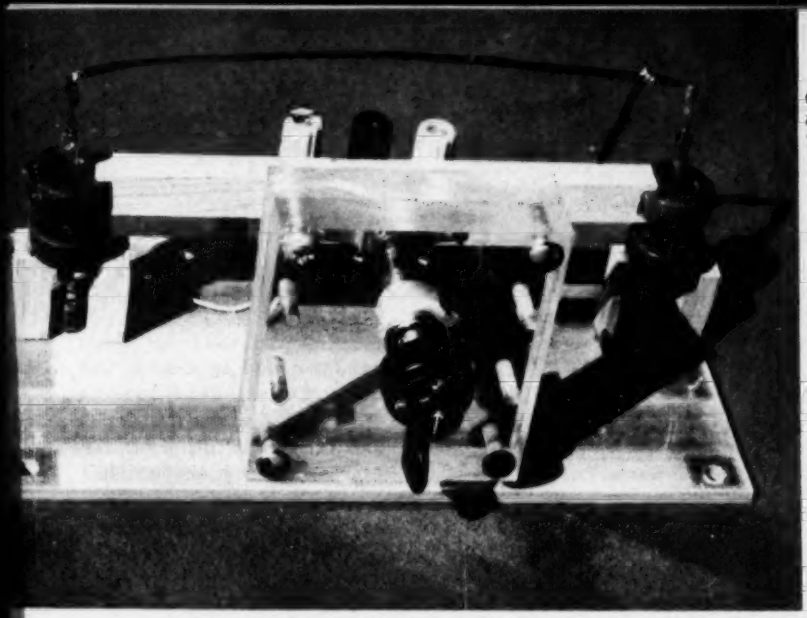


Chuck Hines K6QKL
8615 Idelwood Dr. SW
Tacoma WA 98498

THE FERROUS WHEEL CW PUMP

Unless tradition has grasped you by the throat or your concern for CW is limited by your gag reflex, you have a more than passing interest in the use of electronic keyers. They don't seem to inspire the sort of affection one feels toward a good receiver of faithful beam. Still, the keyer invokes the fascination of any good gadget. Push a button, turn a knob, and watch the thing go all by itself. The integrated circuit with its micro gates and flip-flops has made the keyer attractive to the amateur. The problem is mostly in what one uses to key the keyer.

Three states are selected by that device: dots, dashes, or nothing. Most keys are mechanical variations of the old straight key. A "paddle" is mounted so that motion or compression cause physical contact which in turn allows electrical conduction. A lot of silver and gold plating goes on those contacts in order to reduce their switching resistance. Even so, intermittent or unreliable keying is a frequent result. Keys of varying quality and reliability are commercially available. Flip through the ads. Note the swell prices on those joules. Eighteen to twenty-six bucks is about all you can get them to take for a key. Motivated by the usual theological conviction that money should remain in my wallet, I set out to build my own. The ferrous wheel CW pump was the result, and its construction is recounted here for your convenience and continued solvency.

The first problem is to get a reliable, low resistance switch. That has to be mighty low because the magnitude of the currents being switched is inordinately small when compared with the stuff we're used to switching around the shack. The magnetic reed switch has the admirable qualities required for the job. Hermetically sealed, able to cycle in a millisecond and handle up to an ampere, works in any position – and has a contact resistance in the order of 50 milliohms. Since the gadget is sealed, we won't have to worry about the contacts oxidizing and increasing in resistance, or dirt or stray fur from the cat getting inside. The switch configuration is sketched in Fig. 1. Just two pieces of overlapping metal mounted in a glass cylinder. The switch is normally open,

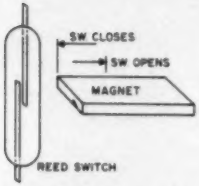


Fig. 1. Traditional reed switch configuration – two pieces of overlapping metal in a glass cylinder activated by bar magnet.

Fig. 2. Reed switch activated by "ferrous wheel" magnet.

and it is closed by moving a magnetic field into proximity to the middle of the cylinder. Reed switches come in different sizes and cost $1 or less. The reed switch has an imperfection, though. In Fig. 1 a bar magnet is brought up to the switch, and the switch closes at the distance indicated. As the magnet is withdrawn from that point the switch doesn't immediately open, however. The magnet has to be removed to the second position shown before the switch opens. This is inconvenient behavior. Clearly a key wouldn't function in an orderly fashion just by sloshing a bar magnet around in proximity to a pair of reed switches. Pity.

A solution was found in a doughnut shaped magnet. I'm calling this doughnut shaped magnet a ferrous wheel in order to make sure you or someone else doesn't confuse it with the ferrite toroids upon which sundry transformers are wound. The ferrous wheel is a genuine magnet. It has two poles. Two of them placed close together will either attract or repel one another – depending upon how they are oriented at the moment. The field of a ferrous wheel is quite different from that of a bar magnet, and you may enjoy sprinkling some iron filings on a sheet of paper and examining that field . . .

Now take a look at Fig. 2. A ferrous wheel is slowly moved with respect to a reed switch extended through the "hole of the doughnut." As the switch first enters the hole, the reeds close and then open again. This is not the switching region we want to use. Continue until the ferrous wheel approaches the center of the switch. You'll hear it click closed. With the switch centered in the wheel move one or the other and measure the total travel of the wheel necessary to allow the switch to open again. This distance is going to vary with the strength of the particular magnet involved, its shape, and the inside diameter of the hole. The minimum travel required on the wheels I used is three thirty-seconds of an inch. That's hardly the most sensitive switching device to be produced by contemporary primate technology. Still, it functions very nicely when configured as a pump.

There are a number of possible ways to configure a switch usable for keying purposes. For the preservation of symmetry I built the ferrous wheel CW pump pretty much as you see it lurking in Fig. 3. Now, if you bought your last key in 1927, and have had it anchored to the desk top with three wood screws ever since, this may take some getting used to. Don't rush it. Sit back and glare and let your stomach settle. The key begins with a pair of bearings mounted in a bearing block of some sort. A shaft extends through those bearings, and non-radial motion is prevented by a pair of keepers mounted on the shaft. At the near end of the shaft a knob is mounted. The far end of the shaft is fastened to the middle of a mast, and a ferrous wheel is mounted at both ends of that mast. Stand-offs are placed on the baseplate and one lead of a reed switch is soldered to each stand-off leaving the free end of the reed switch to extend vertically through a ferrous wheel. When force is applied to the knob, torque is placed on the mast, moving a ferrous wheel down over a reed switch causing the contacts to close. To allow the bar to return to its original position when force is removed from the knob, the repelling field of two oppositely polarized ferrous wheels is used. Since the forces balance on each side, they act much as two springs. Keying the pump unbalances

the forces between the opposing magnets. Releasing finger pressure allows the mast to return to its static, balanced condition.

Construction

The picture should answer most of your questions. For the most part the key is constructed of certified rubble and litter left on the basement floor from old projects. The base is a piece of fiberboard; the bearing block, two pieces of plastic bolted together and glued to the base. The mast and lower wheel supports are ½ in. balsa wood. The magnets used are from the toy counter of the local hardware store, come four to a pack, and are called "Magic Rings." There is nothing particular or special about them; use the lightest, strongest ones you can find. The reed switches used are GE-X7 packs available in the General Electric Experimenter line. (Very small reed switches are mounted in the reed relays available from Poly-Paks. There are four reeds inside the coil winding, each ¾ in. long, and they should be removed with great care if you plan to use them in this application.) The most reasonable source of bearings is surplus. You need two that will fit available shaft material. They usually fit tightly on the shaft, and the shaft must be carefully deburred after cutting. The shaft must turn freely in the bearings, and keepers are needed to keep the shaft from sliding out of the bearings. The pump is a cut-and-try affair and measurements are after the fact. The balsa mast is notched and the wheels glued in place with airplane glue. Wheel spacing is 7 in. center to center. Use what you like. If the mast is too short you'll lose mechanical advantage – and if it is too long sensitivity is increased but there is a tendency to mechanical oscillation. Color code your wheels with a dab of paint so you can recognize their north and south poles. *Mount the wheels with the polarity orientation shown in Fig. 3. Like poles must be adjacent to one another.* Put the properly polarized bottom wheels over the stand-offs and solder the reeds in place. The gap between the top and the bottom wheels is, again, a matter of taste. Mine ended up about 10/32 in. apart.

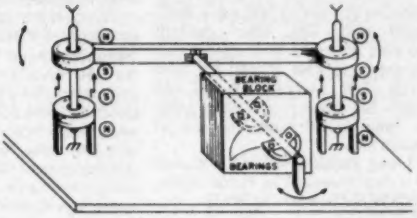
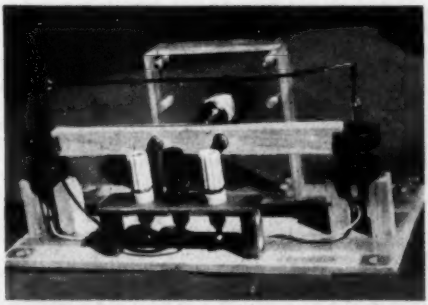


Fig. 3. Configuration of K6QKL's ferrous wheel CW pump.

Adjustment from this point on is a matter of piddling with spacing and balance and is most easily done by moving the reeds or bottom wheels up and down. When the mast is balanced both switches should be open. Pressure on the knob should close the switch with little movement. Equal pressures should close each switch. If the force required on the knob is too high, increase the gap on both sides between the wheels and their repellers. Be quite sure the repellers are mounted low enough so that *they* don't cause the reeds to close.

The ferrous wheel CW pump in the picture was built to see if an idea would work, and it did. Having established that, there is no reason yours should be so barbaric in appearance. With about five minutes' reflection you should come up with at least two other possible configurations of such a key, using essentially the same switching method but a different mechanical arrangement, construction technique, and materials. Try them. This is inexpensive ground to dabble in, and it is always rewarding to build something in a different fashion and discover that it works.

. . K6QKL

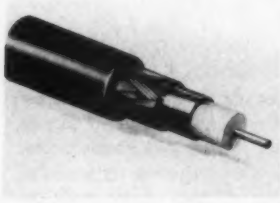


What K6QKL's ferrous wheel looked like when it was done. All this beauty and it works, to . . .

The output circuit features a bandswitch with 20A silver contacts switching a heavily silver plated coil. A vacuum variable is used for plate tuning. T/R switching is fast and quiet – full break-in is a panel selected function – through the use of vacuum relays.

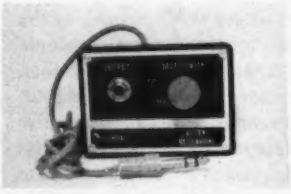
If you are seriously in the market for a fine linear, write *Payne Radio, Box 525, Springfield TN 37172.*

LOW LOSS COAXIAL CABLE



Blonder-Tongue has developed a new line of coax cables for cable television networks. Twelve new types are available including RG-59, RG-6 and RG-11. Their top-of-the-line #4851 feature 12 gauge copper-clad aluminum center conductor and aluminum tape shielding with 50% aluminum braid. This particular cable has an attenuation factor of only 1.6 dB per 100 ft at 470 MHz! The RG-59 and RG-11 types, while not performing quite as well as the #4851, offer improved loss characteristics over regular foam types. They could be used to a high advantage where VHF or UHF installations require long lengths of cable. For more information write *Blonder-Tongue Laboratories, One Jake Brown Road, Old Bridge NJ 08857.*

CW FILTER



Autek Research has come out with a new audio filter that is going to be a big help to Novices and serious CW men alike. Their "Q-Box" is self-contained and affords variable audio selectivity from approximately 2 kHz down to 30 Hz by a simple twist of the selectivity control. There is no insertion loss and the output is high enough to drive headphones or an external speaker amplifier.

This unit is a must for anyone using an inexpensive receiver or a sideband transceiver in our crowded CW bands. All you have to do to put it into operation is to plug it into the headphone jack of your receiver, plug your headphones into its output plug, and turn the selectivity control to the desired amount of sharpness. This is made possible by Autek's use of a transistorized active filter that passes tones near the design frequency of 800 Hz and rejects all others (namely all that QRM right next to that weak signal you are trying to copy). The circuit is powered by an internal 9V battery and requires no power from your receiver.

When the Q-Box arrived at 73, I immediately rushed it downstairs to the ham shack and connected it to our Signal/One. Tuning to the 40 meter Novice band/traffic-jam and adjusting the selectivity control back and forth only affirmed my suspicions . . . the Signal/One has an awfully good receiver section all by itself! The Q-Box did, however, act as a fine trimming selectivity control . . . it would be very useful in contests and when conditions really get rough.

After scrounging around a bit in the back workshop, I came up with an old home-brew receiver that someone had packed away years ago. Here was an excellent receiver with which to test the Q-Box. It had two i-f stages at 1700 kHz and the selectivity was bound to be awful. It was. The situation in the 40 meter Novice band was so jumbled that only exceptionally strong signals were readable. This was going to be an acid test! I plugged in the Q-Box and turned the control to maximum . . . what results! Each signal now occupied a tiny space in the spectrum. I had to back off on the selectivity control a bit, for the receiver just wasn't stable enough to use all that selectivity. Signals kept drifting out of the 30 Hz "slot" and would disappear. After adjusting things for a good balance between selectivity and ease in tuning, I went looking for weak signals. I found one that was perfectly readable and, seemingly, all alone. Was I ever wrong. Backing off on the Q-Box control caused that nicely readable signal to be clobbered by strong QRM that was lurking just out of the sharp bandpass. Being suspicious, and just to prove to myself that the QRM didn't just appear at the moment I turned the control, I turned the selectivity slowly up again. Just as slowly, the signal started climbing its way out from under the QRM and became copyable again.

The variable selectivity feature of the Q-Box is really a plus if you have had any experience with surplus toroid filters. The toroid filters could be switched either fully in or fully out. This caused problems if the desired signal was not tuned exactly on the nose, for you usually had to go looking for the signal all over again once the filter was switched in. With the Q-Box, the selectivity can be applied gradually as the receiver tuning is touched up to keep the desired signal centered in the ever-narrowing bandpass. The selectivity can also be tailored to the prevalent band conditions. If maximum selectivity is not needed, the control can be adjusted to a medium that allows good copy and effortless tuning.

While not quite as good as a steep skirted mechanical or crystal CW filter installed at the i-f level of a receiver, this audio filter can make the big difference between copy and no copy during bad QRM . . . especially if you *don't* have that expensive mechanical filter. $17.95 from *Autek Research, Box 1494, Canoga Park CA 91304.*

WIRELESS RECEIVER

No, this is not a grand announcement of the invention of radio. In fact, the new receiver offered by Lowcom Systems doesn't make use of radio waves at all. Operating on the principal of simple audio induction, it enables anyone to set up a reliable short range communication system for the home, shack, or even small business.

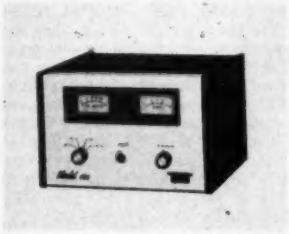
It works like this: A large audio field is generated. This is easily accomplished by stringing a wire around the area of proposed usage. The wire is fed by the audio from a ham receiver or PA amplifier and the volume is adjusted until a comfortable signal level is heard on the Lowcom unit. As long as you stay within the audio field you are in range. The larger the field, the larger the range.

One use that can immediately be thought of is repeater monitoring. Since repeaters are usually monitored continuously, every stray squelch-tail and "QRZ" echoing through the house just brings the situation closer and closer to divorce court. Why not

make everyone happy? Just string a wire around the outside of your attic and feed it with the audio from your FM rig . . . plug the Lowcom earphone in your ear . . . and walk around smiling. Do the same while you are waiting for the HF net to get started. No need to turn the audio gain way up while you are eating dinner. Just listen in on the Lowcom. No one will know the difference until half way between mashed potatoes and pie when you leap from your chair heading for the shack.

The unit is available for $15.95 in kit form or $24.95 wired from *Lowcom Systems, 10727 Indian Head Industrial Blvd., St. Louis MO 63132.*

TEN-TEC LINEAR



TEN-TEC Inc. has announced the introduction of the Model 405 Linear Amplifier to their line of amateur radio equipment. Completely solid state, the amplifier delivers 50W of power to the load in the frequency range of 3.5 MHz to 30 MHz when driven with less than 2W. Features include broad band design, two panel meters indicating rf power and standing wave ratio, exciter-actuated changeover relay with adjustable delay time and 12V dc operation. Its small size and light weight make the amplifier ideal for use in portable, mobile, marine and aircraft applications. The price is $149.00 – ac power supply is $49.00. Write to *TEN-TEC Inc., Highway 411 East, Sevierville TN 37862* for further information.

TEN-TEC RECEIVER

TEN-TEC, Inc. has announced the introduction of the Model 315 Communications Receiver to their line of amateur radio equipment. Completely solid state, the receiver covers the amateur bands between 3.5 MHz and 30 MHz. Features include permeability tuning, linear frequency readout, 9 MHz crystal lattice i-f, pulsed crystal calibrator and low noise MOSFET rf amplifier and mixer. Built-in regulated 115V ac power supply can easily be converted for 12V dc operation. An accessory plug-in audio filter is available to narrow the bandpass to 300 Hz for CW reception.

The Model 315 was designed for the amateur who demands the exacting requirements for DX, traffic, contest, net and general operations, as well as the beginner. Price is $229.00. Model 235 CW Filter is $14.95. For further information write to *TEN-TEC Inc., Highway 411 East, Sevierville TN 37862.*

PORTABLE TEST LAB

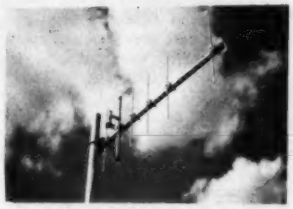
The Lee Labs Dynamic Serviset is quite a little piece of equipment. It is basically an rf/af signal tracer, but with a horde of extra features. Built into it is the ability to test the prsence of ac or dc voltage and substitute three different ranges of resistance and two ranges of capacitance. It can also test the resistance of a particular circuit and even determine the leakage of a capacitor. The amazing thing about this device is its ability to make fairly accurate checks on circuit conditions without the need for extra (expensive) equipment.

Because it is self contained, the Lee Serviset makes troubleshooting really easy. This is especially true when working on tiny printed circuit boards. The work area doesn't have to be cluttered with a tangled mess of test leads coming from VOMs, resistance substitution boxes and transistor checkers because you can perform all those functions with one hand held unit. Functions are selected by repositioning a single test load.

Suppose you have traced a signal in a malfunctioning receiver up to, say, the second i-f stage, but you lose it as you go on to the next. By changing the test lead position on the Serviset you are able to use it as a voltmeter to check the corresponding voltage levels at different points at the i-f tube or transistor. If no voltage appears at the plate, the Serviest can then be used to check the condition of the load resistor and bypass capacitor. If one of these are found faulty, the unit can quickly substitute a value to confirm the fact by restoring operation. Sounds easy? It is.

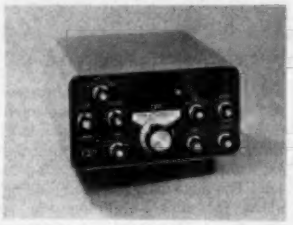
The Dynamic Serviset is manufactured by *Lee Electronic Labs, 88 Evans Street, Watertown MA 02172.*

450 MHz YAGI



Cush Craft has just introduced a new 6 element rear mount 450 MHz yagi for amateur FM repeater operation. It can be used for control links and stations for monitor applications and access to 450 MHz repeaters. It is priced at $10.95 amateur net and exhibits 10 dB gain. It has direct 50Ω Reddi Match feed with built-in coax fitting. The boom is 35" long and overall weight is 3 lbs. Model No. A449-6 is available through all Cush Craft distributors. The antenna is also available for commercial service. *Cush Craft Corp., 621 Hayward St., Manchester NH 03103.*

SOLID-STATE SWL RECEIVER



Heath Company, world's largest manufacturer of electronics, has brought to market a new professional solid-state SWL receiver, the Heathkit SB-313. The unit covers 9 switch-selected shortwave bands between 3.5 and 21.8 MHz; receives SSB, CW, and AM with professional performance. A 5 kHz AM crystal filter is supplied with the kit, with separate SSB and CW crystal filters available as optional accessories. Outstanding stability, selectivity and sensitivity are the result of advanced-design all solid-state circuitry including 19 transistors – four of which are MOSFETS; 11 oscillator crystals and one IC. Pre-assembled and aligned Heath LMO

offers good linearity and highly stable tuning. Large dial calibrated in 1 kHz increments makes for easy tuning. An IC crystal calibrator provides markers every 100 kHz or 25 kHz. Other features are a transistor-regulated power supply for stable voltage to all oscillators under varying line and load conditions; an rf attenuator that allows adjusting sensitivity for best signal handling; virtually backlash-free dial tuning; modular plug-in circuit boards plus ready-to-use wiring harness for easy assembly; and special extender boards for troubleshooting even while set is operating. An 11-MΩ input VTVM, and 8Ω speaker or headphones, and an antenna are all that are required for alignment.

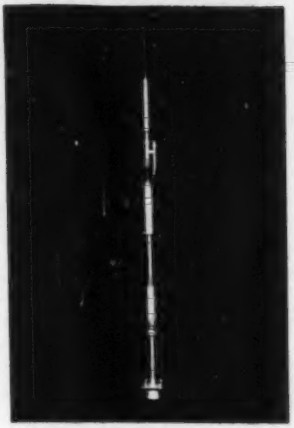
Kit is mail-order priced at $339.95 F.O.B. Benton Harbor. For further information, write *Heath Company, Benton Harbor, Michigan 49022.*

"M" SERIES MOBILE GAIN ANTENNA

The "M" Series antenna by Antenna Engineering is a full 5/8-wavelength vertical whip with a bottom-load matching transformer. It is designed for vehicle-mounting in a 3/8-inch hole. The adjustable threaded bushing allows for either roof-mounting or through double-panels. The matching transformer is encased in a fiberglass sheath which is nearly indestructable. The whip is of 1/8-inch spring-temper type 302 stainless steel; the coil tip unscrews to accept a chrome-plated spring (optional at extra cost) for severe service applications.

This antenna is available for all amateur frequencies in the 146, 220 and 440 MHz bands. The "M" Series antennas are at dc ground for dissipation of static, and are supplied with 20 feet of type 58A/U coax and UHF connector. Prices range from $16.95 for the 2 meter version to $15.95 for the 3/4 meter version. Contact *Antenna Engineering Co., Inc., P.O. Box 19449, Indianapolis, Indiana 46219.*

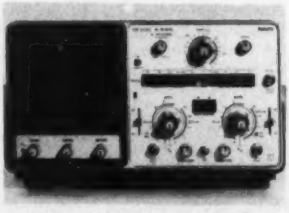
"B" SERIES BASE STATION COLLINEAR



The "B" Series antenna by Antenna Engineering is a triple-skirted collinear antenna operating with a decoupling ground plane. These are seven quarter wavelengths, designed for vertical polarization, and are available for all amateur frequencies in the 146, 220 and 440 MHz bands. Unlike many antennas of this type, the "B" Series is at dc ground for positive lightning protection, and the gamma-type feed is located on the radiating structure for symmetrical current distribution. This feed system will match 25 to 100 ohms for use with various transmission lines and in phased-arrays.

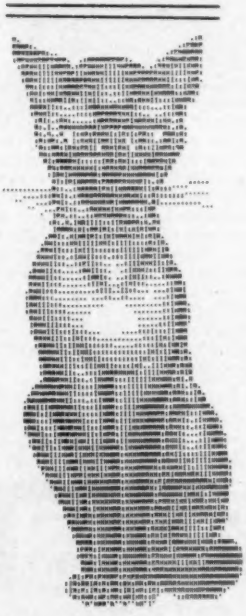
The supporting mast is heavy-wall 6061-T6 aluminum alloy, and the radials are spring-tempered type 302 stainless steel. A mounting receptacle is provided for 1-inch NPT pipe. The unit is quite rugged for its light weight. Termination is by type 8/U coaxial cable. Prices range from $39.95 for the 2 meter version to $29.95 for the 3/4 meter version. Contact *Antenna Engineering Co., Inc., P.O. Box 19449, Indianapolis, Indiana 46219.*

DUAL-BEAM SCOPE



This new Philips instrument is offered at approximately $900 as the successor to the widely used Philips PM3230 for a wide variety of applications in industrial electronics including telecommunications, television, education, computers and peripherals, and electronic maintenance.

The PM3232 combines a number of features that can often eliminate the need for a more expensive, higher bandwidth instrument when only one or two individual features, such as 2 mV sensitivity across a wide band or dc triggering, are required for a particular application. In addition to being a true dual beam instrument and therefore having no possibility of phase displacement between the two traces, the PM3232 also offers universal triggering facilities including automatic level, dc coupling, and automatic TV line/frame selection. Its sensitivity is 2 mV/cm everywhere in the 10 MHz bandwidth of the instrument. The newly designed Philips CRT has a large 8 x 10 cm screen and excellent light output dervied from the post-deflection acceleration system so that even low duty-cycle, fast-sweep signals are displayed clearly. Detailed information on the PM3232 and on the entire line of Philips instruments available in the U.S. may be obtained by writing to *Test & Measuring Instruments Inc., 224 Duffy Avenue, Hicksville, N.Y. 11802.*



RTTY ART

Here is an example that originated with Don WA6PIR. Have any good examples that you want to see in these pages?

LETTERS

ou goons don't ever proofr
lousy [illegible] from bob
bunch of rocks [illegible]n
you ignored my comments in
I insist that you print ev

THE COVER...

My husband is a ham and enjoys 73 very much. On occasion I will pick up one and read a few articles and enjoy them also.

I ran across the Letters section of the December 1972 issue that I would like to comment on.

After reading Mrs. Shera's letter about the October cover I decided to conduct a little experiment. I asked my husband his thoughts on the October and November 1972 covers. He thought the "equipment" was really outstanding. My husband is an admirable man and only has the best of intentions.

Therefore, I'm sure there were no adulterous thoughts lurking in his mind. If a man gets to where he doesn't enjoy looking at a pretty girl, my best suggestion would be to find the closest mortician!

I would like for you to please give equal space to Mr. Shera and let us hear his opinion of the covers in question.

Keep up the good work at 73 and please use a picture of Burt Reynolds on one of your covers to please the lady readers of your magazine. Who knows, Mrs. Shera might like that.

Mrs. H. Hogan, Jr.
Cheraw SC

But then... would your husband write us a nasty letter??

Sent in my renewal last week, and after getting the November issue today, I am glad I did.

About your new cover format, that's a cute rig she's holding, but my non-ham O.M. is beginning to wonder about the magazines I subscribe to! I suppose with the small number of licensed YL's, we'll have to resign ourselves to being addressed as "Mr." or "O.M." – but couldn't you at least refer the cheese cake minded to a different magazine? Or at least give us YL's a good looking man to look at!

Mary Haynes WB8MAV

Normally I'm not a complainer, but lately the YL has become very suspicious with all the brown-wrappered 73's which have appeared at the door. Naturally, when I tell her that it is only 73 Magazine, a radio magazine, she looks at the cover and doesn't believe me, because of accessories often attached to the equipment, which aren't often included in the purchase price of the otherwise – I'm sure – good equipment. It has occurred to me that maybe you ought to put a centerfold in 73. However, to please the YL, it should be some complicated circuit, instead of a complicated blond, like "that other magazine." It's not that I have anything against blonds (after all, they have more fun), but somehow, I think a radio magazine ought to have a fold-out circuit. If you need to fill the other side of the centerfold, maybe a blond would be good (it would save me money, since I wouldn't have to buy the "other magazine").

Seriously, I enjoy 73 and hope you keep up the good work. It will probably take me a month, though, to read your last issue, since I can't seem to get past the cover.

Kent Cronyn WA2DRX
Tiffin OH

I am a high school student and generally take 73 to school to read in my spare time. But if you insist on putting on cover pictures such as on the October and November issues you will end up thinning your youth ranks considerably. All kinds of rumors have been started about me and I was nearly expelled once before I could prove that it really is an amateur radio magazine. Believe me, people don't notice that the lady on the cover is holding a 2 meter rig. Please consider my plea before I end up in big trouble.

Steve Antosh WB5BNM
Shawnee OK

A comment on the November issue... WOW! I haven't had a chance to get an actual count, but there must be more articles in this one issue than in an entire year of QST and CQ combined. Who wants 40 pages of operating news anyway?

When I first saw the issue on my desk, I was sure you had finally published your cumulative index, or at least the entire FCC rules and Regs. Let's see CQ top this one.

Ron Warren WA2LPB
Fredonia NY

Thanks for the fine November issue. In fact, your covers the past few months have gotten my wife interested in what I'm reading – and she might become a devotee if she sees enough of those type of covers; she doesn't want to let me read anything like that without her knowing what's in the center(fold?)!!

Wayne Heck WB9HJM
Ft. Wayne IN

My lawyer will be in touch with you. As you can see from the address, I am in the Folly Beach General Hospital with a hernia received trying to get the November issue of 73 out of its wrapper.

(Seriously, am glad you stayed home awhile to mind the store. November issue is great. Always thought you could do it if you would stop running all over creation & attend to business. Am proud of you.)

Ed Howell W4SOD
Folly Beach General Hospital

First my dog attacked my mailman, then you people at 73 sent this magazine (November '72), its size massive, gigantic and dynamic. This was the last straw for my trusting and loyal postal servant. Things here in Vancouver are about ready for the A.R.E.C. My dog and I thank you so much; keep it up!

Jerry Dimmitt WA7MMD
Vancouver WA

I am sure the Womens Liberation Movement would dub you a "male chauvinist pig" as a result of your November cover.

What disappoints me is that you have an excellent magazine and you really do not need bullshit like that to sell it; or is it possible that you really do not know how good your publication is?

Mike Peters W9GHY
Scandinavia WI

As spokesperson for the 73 Women's Lib local chapter, I assure you Wayne was labeled a Male Chauvinist Pig long, long before the November cover.

However – in all fairness and because he is our boss – I make the point that the young lady willingly posed for the bullshit, so what does that make her?

And you know – most of you DO like the cover!

Ruthmary Davis

P.S. We don't know it is an excellent magazine because we aren't hams, but Wayne tells us it is.

WA6TDD

I suppose that the following is my own fault for not writing earlier and correcting it. In your recent Repeater Listings and other ones around, they show WA6TDD in L.A. as hasing an input of 147.420 MHz, with an output at 146.40 MHz. The inputs, of which there are two, is FM at 147.435 MHz and AM at 147.405 MHz. I realize this is an odd-ball situation. TDD has been an AM open channel repeater on Mt. Wilson since Nov. '62. At the time we were at 145.425 MHz, with the AM input. The repeater was always very active except for approximately one year's time when it was off the air for many reasons, none to do with amateur radio. Last April we added an FM input at 145.195 MHz.

These frequencies were picked due to intermodulation problems on Mt. Wilson and at the same time to fit in between the other activites on two meters in the L.A. area. The activity was about equal between the two inputs, with both growing equally. When the docket came out it forced us to make a ddecision whether or not to abandon the AM or the FM input. The "Frequency Coordinating" Committee was not about to let TDD have two inputs. I can understand their thinking in part. But contrary to public belief there is a great deal of interest still in AM mobile operation. The people that operate the other repeaters that are FM only are not aware of the AM operation on the band. Besides the attitude that is shown by many that "Ancient Modulation" does not need a repeater, so TDD should only have one input and one output. This was put to the users of WA6TDD as to what they wanted to do. We decided that we would split the input channel and have both the AM and FM inputs. Both receivers have always had the overall band-pass to operate in this manner. We used to have a CD group operating about 15 kHz off of the AM input without any interference. But it meant that the users of TDD had to either have good VFOs or accurate crystals. They got 'em and used 'em.

Burt I Weiner K6OQK
Van Nuys CA

MINICOMPUTERS

I just received and perused the Nov. issue of 73 and was utterly boggled by its size and content; I wish your advertisers and staff time would allow things to "get out of hand" like that a little more often!

As a professional computer programmer/sometime computer-maintenance technician, and a reader of 73 almost since its inception, I was particularly delighted to read Jim Huffman's introduction to the design of minicomputers. I agree with his premise that increasing IC sophistication and declining costs will very soon place home-brewed minis within the reach of most hams and experimenters, and it seems entirely appropriate (and perfectly in keeping with 73's tradition of publishing "meaty" construction projects using state-of-the-art circuitry months ahead of any other experimenters' magazine) that such an article should appear in 73. In fact, I would have been gravely disappointed had "Popular Electronics gotten there ahead of you!

In addition to concerning themselves with the design and construction of a mini computer, it seems to me that hams would do well to give some thought to the incorporation of minis into amateur communications systems; for example, for microwave enthusiasts to begin discussing and exploring the possibility of establishing amateur data-communications systems, not only between ground-based stations, but also with an eye toward the possibility of utilizing digital-data transmission in future OSCAR-type projects.

The Intel Corporation (3065 Bowers Ave., Santa Clara CA 95051) manufactures a unusual MOS LSI chip, the 8008, which includes the entire "guts" (i.e., Arithmetic-Logical Unit, Instruction Decoder and Control, several internal registers, an I/O-bus buffer, and timing generator) of an 8-bit minicomputer in an 18-pin DIP; essentially it's a CPU-on-a-chip which need only be interfaced to a memory sub-system and some appropriate I/O device-controllers to make a fairly sophisticated bus-oriented mini. The manufacturer publishes a data-booklet describing the 8008 and several other chips that make up its "MMCS-8 Micro Computer Set" which presents an excellent description of the operation of the CPU, how to incorporate it into a minicomputer, how to build a simple Teletype controller, and lots more. It's an excellent supplement to the Huffman article, and worth its weight in gold to would-be computer constructors.

The chip itself, I'm told, costs about $200 for single quantities, which is outta sight for an IC, but dirt-cheap for a computer.

In summary, I see great room for experimentation by hams in the development and use of minicomputer systems, and I am pleased to see an initial presentation of the subject in

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73. I would like very much to encourage readers with an interest in this field to get to work on concrete hardware development, and hopefully share their results with us via 73.

Scott Marovich
Chicago IL

My article in the September issue, "The CW Excavator" has an error that may cause some unsuspecting experimenter to test his religion or maybe blow his top: on page 32 the equation for bandwidth and R_1 are in error. The equations should be

$$R_1 = \frac{1}{\omega_1 Q_1 (C_1 + C_2)} =$$

$$\frac{B_1}{2\pi f_1^2 (C_1 + C_2)} \quad \text{where } \omega_1 = 2\pi f_1, \quad Q_1 = \frac{f_1}{B_1}$$

Consequently the equation forbandwith should be

$$B_1 = \omega_1 f_1 R_1) C_1 + C_2) =$$

$$2\pi f_1^2 (C_1 + C_2)$$

The next to the last paragraph has a few words missing from the second sentence. The second sentence should read: The gain of the filter is about unity for 800 Hz, so there is little change when the filter is switched "in" or "out," but a comfortable level phone signal with the filter "out" disappears when the filter is switched "in."

For what it's worth, the article seems to have rung a bell for many of your readers, because I had letters from several asking about PC boards and IC substitutions a full two weeks before my subscription issue arrived.

Parker R. Cope
Amsterdam NY

Didn't you come on a little bit too strong in your editorial "Incentives" in the Sept. issue of 73? I was forced to read your editorial twice, as I couldn't believe quite what had been written.

I have often felt that the FCC examinations for the incentive licensing program were for the most part pretty fair. Some areas of a particular exam might possibly be rougher than others – dependent upon each individual's own preparation and interests. However, no portion of incentive licensing should be condemned as you did so with the code.

As the top grade within the amateur radio licensing structure, the Extra Class license should require knowledge and proficiency in the basic aspects of amateur radio operation – mainly, voice and code.

Your editorial, as I read it again, didn't even mention that Extra Class license holders are granted additional allocations of our bands for CW operation, not just the additional bandwidth for voice operation. Perhaps this is why the FCC has the 20-wpm code requirement in addition to the technical examination.

If anyone has the right to complain, it should be the dedicated CW operators who are required to pass the Advanced Class license examination in order to be eligible to sit for their Extra Class ticket. What does the CW operator do with additional phone privileges? This surely must seem unfair to many.

As amateur radio operators, we should, as we are now required by FCC, be virtually proficient in all aspects of amateur radio – not just in the area of our own personal interests. Nonetheless, the exams are there and we must live and abide by the rules, regulations, and requirements as imposed by FCC until such time they are changed or amended – no matter what our personal feelings or interests tend to be.

Marc B. Miller XW8EV/K3NAS

73 Magazine is the best ham magazine I have read – the ads are best because you have confidence in them.

The "Petition to the FCC" by George W. Fyler W9JT, was the best I ever read. It is clear (to me) that he should be writing the FCC Rules and Regulations for the FCC. Can we not petition the "President of the United States"? The FCC has too much power for such little action and consideration. I am a member of the ARRL but I feel they go along with the FCC. Anyway, I worked for the Federal Government for 32 years. "Nuf" said.

I will help any way I can in the above Petition, but?

Bill WB4SNK
Jacksonville FL

K4YKB and his "TEN-ROGER" dissertation (Nov. 73) sent me into hysteria! Paul Rinaldo of McLean VA has run-off one of the most ungodly truth filled articles I've had the pleasure of digesting in a great long time.

It is my misfortune to be among the fraternity of the few remaining "legal" CBers (KFA6162) that date back to about 1959 when the band was being used for the purpose intended; and now it's a #*+%&@$%S mess to say the least.

It was reported that one of the local L.A. CBers purchased for cash money across the counter (name of store undisclosed) one of HENRY RADIO's hard punching KW "afterburners" – that will give you some idea of what we might expect on the proposed "CB 220 MHz" deal.

So, come on hams – get your 220 gear on and shoot the Federal Candy Company some of that there "wallpaper" protesting the EIA proposals – TEN-ROGER yaall?

Bill Ford WB6SNU/KFA6162
Pomona CA

I saw your editorial regarding the elimination of CW as a requirement for the Extra Class license and thought I'd give you a CW operator's point of view.

Since you do not operate CW, the only band segments you have lost are a small section of 75 and 15 meters. But as a General Class licensee and a CW operator, I have lost the choicest 25 kHz segments from four bands. The 20 wpm code exam is nothing for me, but why should I have to learn a lot about single sideband just to crank my vfo down to the bottom 25 kHz of each band? I feel that the *only* requirement to operate in the Extra Class CW bands should be the code exam.

When it comes time to renew my license, at least I can state with a clear conscience that I still have the minimum code speed required for my class of license. I wonder how many of the "phone only" operators can do the same.

Bruce Koehler WBØBCT

(Most, I think, for I notice my code speed does not change much even when I don't use it for a year or so. It only takes a couple minutes to get back in the swing of it. Wayne.)

I am a CB'er and am trying to get involved into this 220 bit.

I would like to say right here and now, I feel the amateurs are entiled to 220, and the fathead who thought of using 220 for "CB" should be stood up against a wall and shot!

Yes, CB is crowded and noisy, but if the money hungry idiots at this EIA, a reactionary outfit, would just get it through their fat heads, they'd realize there are plenty other frequency ranges available, not necessarily amateur radio bands, but possibly the government would give up one of their sacred bands.

Then there is the possibility thatCB could go FM (no offense intended), and possibly some other modes such as, preferably, RTTY.

You all think I may have a wild imagination, but I'm not very interested in amateur radio (sorry about that!), but experimentation of CB with such modes would be most interesting for those like me.

Enclosed is a money order for one of your "220 use it or lose it" shirts.

Jim Buscher III
Arlington VA

Immediately upon reading Cliff Klinert's excellent article on solid-state ID in the October issue, I set forth to produce a unit for our new repeater here in Norwalk, Conn.,

W2NSD/1 continued.....

MAY WE GET 11 METERS BACK?

It's pretty definite now: the Crazy Bunch will be coming to 220 MHz – that's the bunch now filling up the eleven meter band with illegal power – illegal antennas – illegal towers – illegal VFOs – illegal skip contacts – illegal hamming – illegal call signs – unlicensed operation – profanity and obscene language – widespread use for crime communications, which is illegal – and so on.

While the amateur frequencies that are going to be turned over to this bunch of . . . unusual people . . . are probably the most valuable and needed ham channels presently not in use, there are some shreds of silver lining to the situation. If FM continues to grow as it has during the last two years it won't be long before the pinch for repeater channels will be painful and the realization will come that amateur radio goofed and goofed badly when it did not set up a lobby in Washington to protect its turf.

Now, for the bright side. When the CBers are scraped off the 27 MHz band and shoved down onto 220 MHz, it seems possible that this band may again be opened for amateur use. Since the neighboring ten meter band is far from bustling, even during peak periods, 11 meters could languish as it did in the '50s unless something extra is allowed. Perhaps this might be the band where the FCC would permit long distance repeaters.

DXing repeaters would be fun, and if we could tie them into our VHF and UHF repeaters with crossband links, they could be extremely valuable for emergency purposes. There is no real shortage of frequencies on the ten meter band for this, but the FCC has conjured up some sort of imaginary congestion that might take place twenty years from now and come down hard against ten meter repeaters. Perhaps the wide open spaces of 11 meters would counter this thinking.

HOW WAS 220 MHz LOST?

The FCC bowed to pressure from congress via the well-heeled EIA Washington lobby. Anyone interested in the inside story on how this situation works has but to read the current best seller, "Who Runs Congress." This is the $1.95 Bantam Books ZY7701 Ralph Nader congress project report.

Since it is estimated that over 90% of the prospective sales of 220 MHz equipment will be of Japanese manufacturer, one wonders just who is actually bankrolling the EIA push for the band. Ah, so? The fact is that the new band will make millions of dollars for Japan – perhaps up to $100 million per year. They'd have to be daffy not to invest a few million in a proposition like that – and no one has accused the Japanese of being daffy yet.

The Nader report will give you the lowdown on how money passes from interested parties through lobbyists to congress, thus buying little baubles like a meg at 220 MHz for the Crazies.

LESSON LEARNED

Readers of the aforementioned Nader congress report wil find that the suggestions made in 73 for hams to have a Washington lobby are backed up completely. Without such a lobby the amateur frequencies are wide open for any group to grab. Only the complete lack of any lobby in Washington for amateur radio made this theft of ham frequencies possible. You might ask your ARRL director to explain again why ARRL has no lobby to represent us in Washington. This has been explained in the 73 pages many times, but is an unpleasant situation and we tend to forget about it.

We need a group to set up a lobby – we need it desperately – where are you – were are you?

CAN HAMS GET SOME TOO?

Any enterprising ham should be able to do very well as soon as the new band is announced. Nice Japanese rigs will be available from Henry, Standard, and others such as Drake, SBE, Swan, etc. Even crystals will be available from Japan for a fraction of the cost of U.S. crystals. Antennas will come pouring in from Japan too. If you want to get into a good big business you can get yourself set up as a dealer and start installing these CB stations and servicing them. Any FMer has the knowledge to set these things up and keep them going.

If this band goes the way of 11 meters – and there is no reason whatever to expect anything different, you may be into selling towers, high powered amplifiers – the works. Watch for some interesting new amplifiers for the band too – several manufacturers are ready to announce some 250 and 500 watt mobile solid state amplifiers – and one is hard at work on a 1000 watt mobile amplifier for the band!

CBers found that once they are on a band in large numbers there is nothing the FCC can do to police the situation – so anything goes. No licenses are needed, obviously. A chap with a base station might worry a bit if the FCC starts a cleanup in his area – but these things never last long and it is always back to business as usual in a few weeks at the worst – and of course there is virtually no way for the FCC to catch a mobile station, so mobile ops don't even have to worry when the FCC is right in town.

Another good business may turn out to be setting up remote base stations for the new CB band. CBers like to work DX and get good wide coverage – and this means a mountain or tall building. Few CBers will be able to hook up the remote control circuits needed for a good remote base station – so there is a fine opportunity for experienced amateurs.

Most of the CB rigs will probably be either crystal controlled or synthesized – which means that there will be a possible market for VFO's for working in between the 25 kHz channels.

Wayne

LETTERS continued.....

W1WHZ. I got about fifteen minutes down the line, when I realized that all of us here in "1"-Land, and I'm sure, many others, have a problem with overloading the eight-bit capacity of the 7430 IC's. Cliff does spell out a rememdy for this in his article using an inversion process and some additional 7400's. While this will certainly work, it does involve some more complication and cost and it reduces the ability to construct a "universal" ID unit which can be easily changed to a new call sign if necessary. This will be important in view of the new repeater rules which will require all of us to change calls in the near future.

I think I have a simple solution to the problem which may be of aid to those of your readers who find themselves in this same situation. The answer, as simple as it may sound, is to allow six units for letter spacing rather than five. This will allow enough room for almost all combinations of characters, with the exception of the poor guy who has a zero in his prefix. There does not seem to be a simple answer for him other than the inversion technique, or possibly allowing additional bit spacing.

William H. Eburn, Jr. WA1OPR
Westport CT

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FOR SALE Regency HR6 and HR2MS still in unopened boxes. Brand New! Swan 500CX, power supply (ac), External VFO, Mark II Linear. Box 3432, c/o 73 Magazine, Peterborough, N.H.

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CANADIAN DEAL! Selling Heathkit DX-60A $60. HR-10 receiver with voltage regulation, modified Pre-amp $50. Good Condition! Want HW32, HW12. Ian Baines, 1675 Wedmoreway, Mississauga, Ontario.

TEMPO FMP transceiver with TPL 252-A2 25w Amp. and Hustler BBLT-155 Ant. $230 takes all. Russ Appleyard WA2MHY/3, 3600 Chestnut St., A121, Philadelphia, Pa. 19104. 315-349-7489.

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OA442-/GR 2 METER amplifier 500 watts out $350. Lampkin 105B freq. meter & PPM excellent condition $150. Douglas Barker, P.O. Box 182, Eatonton, Ga. 31024.

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8 EL. 6M. BEAMS. A/S HM 171 Reg. List $109.95. Close out price $29.95. F.O.B. Cleveland, Ohio. Communication World, 4788 State Road, Cleveland, Ohio 44109.

DIVORCE and alimony dictates that I sell the following fast: CLEGG FM-27A, $300. Pair of Standard 146, $210 ea. First check takes each item. All like new condx. Box 2611, 73 Magazine.

"22nd ANNUAL Dayton Hamvention will be held on April 28, 1973 at Wampler's Dayton Hara Arena. Technical sessions, exhibits, hidden transmitter hunt, flea market, and special program for the XYL. For info write Dayton Hamvention, Dept. 7, Box 44, Dayton, Ohio 45401."

2-WAY TECHNICIAN or SERVICE MANAGER, experienced, needed by expanding 2-way service organization in Dallas, Texas. Send resume to RAM Broadcasting, Attention Cecil White, Post Office Box 10373, Dallas, Texas 75207.

Mann COMMUNICATIONS

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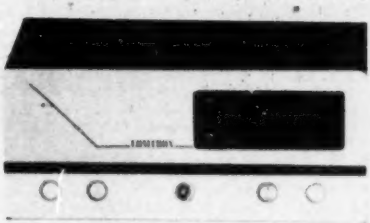

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This unit is all solid state except the driver and final output tubes which are instant heating. Unit is 150MHz Front Mount type 30Watts. Two channel deck included free.

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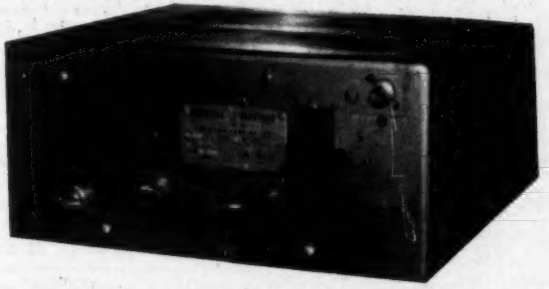
This unit has two 60Watt Hi Band Xmtrs and one Hi Band Receiver for multi-channel operation. Transistor Powered.



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RCA AN/SRR-13 RECEIVER, tuneable 4 thru 32 MHz AM/CW/FSK, 115V/60 Hz, used by the Navy 165.00

COLLINS 51J-4 RECEIVER tunes 500 kHz thru 30 MHz, has 3.1 and 6 kHz mechanical filters, 19" rack mount. A fine communication receiver 550.00

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HAMMARLUND SP-600JX, tunes 540 kHz thru 54 MHz in 6 bands 19" rack mount 285.00

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BC-348, a great receiver for AM/CW and marine VLF/HF work, unmodified original 28VP/S, easy to convert for 12VDC or 115/60 Hz, tunes 200–500 kHz and 1.5 to 18 MHz 65.00

HP-430C RF POWER METER, 19" rack mount, reads directly in DBM or MW. Perfect for any shop or lab 39.00

RT-67/GRC FM ARMY JEEP TRANSCEIVER tuneable 27.0 to 38.9 MHz 16 watts 32.50

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MD-129/GRC-27 MODULATOR, goes with T-217/GRC-27 ..... 39.50

TV-2/U TUBE TESTER, mutual conductance checks old and late type receivers, transmitters and sub-min type. Complete with roll chart and book. Late Viet Nam vintage, the best, cost Govt. $960.00 ..... 65.00

TS-413/U SIGNAL GENERATOR 75 kHz to 40 MHz in 6 bands, precise calibration from 1 MHz crystal oscillator, has % modulation meter CW, or AM 400/1000 CPS variable 0–50% and RF level meter 0–1.0V. Ideal for amateur, marine, aircraft and hobbyist for IF and receiver-transmitter alignment or development work 89.50

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TS-505D/U VTVM 0-250VAC, 0–1000VDC, 0–1000M ohm resistance measurements, AC frequency response, 30 Hz–500 MHz, high input impedance, portable ruggedized construction complete with probe, late military vintage 45.00

AN/PRS-3 MINE DETECTING set in shipping case. A popular unit used for locating relics and lost items. Can be used around salt water and iron soil. Gives meter reading and tune. Takes standard 1½V and 45V batteries, not supplied, original Govt cost $800.00, have fun for only 24.50

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COLLINS 18S-4 TRANSCEIVER, 10 channel crystal controlled from 2 to 18 MHz, 100 watts output, AM/CW, 811 modulators to 813 fine, operated from 28VDC dynamotor included or convert to AC. Ideal for Novice, MARS, RTTY, marine, or aircraft, like military version of ART-13 ..... 47.50

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Make your own counter, frequency meter, digital voltmeter, readouts, etc.
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50 WATTS OUTPUT 25–54 MC

With Accessories

NARROW BAND TRANSMITTER AND RECEIVER

These units have just been removed from commercial service and are clean and in good condition.

Prices	**1 to 5 Units**	**$50.00**	each
	5 to 10 Units	**$45.00**	each
	10 or More	**$40.00**	each

Terms: All equipment sold as is. Money back if returned prepaid and unmodified within five days of receipt. Illinois residents add 5% sales tax. All sales CASH or COD. Allow three weeks for delivery.

Send check or money order to:

COMPARE OUR DEAL

WE WILL NOT BE UNDERSOLD

DuPAGE FM
P.O. Box 1
Lombard, ILL. 60148

Phone: 312-627-3540

WAHL® "ISO-TIP"
Cordless Soldering Iron

Replaceable tips — Use ordinary solder — No cord to interfere — Ready to use instantly — Ideal to use on printed circuit boards, normal home and industry wiring repairs — Easily rechargeable — Place in separate recharging stand when not in use — Recharges from "dead" to "full charge" overnight.

Low voltage with high wattage performance — "Iso-Tip" soldering tip construction eliminates electrical leakage, the need for grounding and the possibility of damage to highly sensitive electronic components — Reaches soldering temperature in 3-5 seconds — Specially designed for good feel and balance — Saves time — Push button operation — Built-in work light and pilot light.

Tip performance equivalent of up to 50 watts and up to 60 joints per charge depending on size of work — Long-life nickel cadmium batteries — Lightweight to eliminate fatigue . . . weighs less than 6 ounces and is less than 8 inches long — Complete safety and total portability — Do those hard-to-reach jobs — Goes where the work is — No drop cords to string or need to search for a power source.

An IDEAL TOOL for:

Radio, TV and Antenna Servicemen Aircraft Servicemen Hobbyists
Home Owners Engineering Laboratories Electrical Departments

$19.95

from

NEW HAVEN AVIONICS

SPECIALS !!

Collins R-391 Digital Readout Rx 500 kHz to 32 MHz	$500.00
Collins R-389 Digital Readout Rx 15 kHz to 15 MHz	$500.00
Hewlett Packard HP616 Microwave Sig. Gen.	$250.00
Boonton 202, 202C or 202E AM & FM 50 – 200	$250.00
Boonton 207	$800.00
Boonton 203	$800.00
Motorola OA 442 250 W Out on 2 MTR	$375.00

WANTED Top prices paid for:

HP 628A
HP 8731B
BOONTON 232A & 235 A

all types of Collins test equipment.

Tweed New Haven Airport
New Haven, Conn. 06512
Phone: 203-467-0148

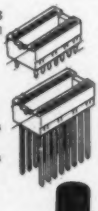
ARE PRICES ON ELECTRONICS COMPONENTS REALLY GOING UP? Of course, no one knows for sure, but we are of the opinion that they are. The recession in the electronics components business is truly over; sales are at a new record. Our, and other "independent distributors" ability to negotiate low prices because of manufacturers' overcapacity is greatly reduced. Many items, such as TTL devices, LED's, and MOS LSI are rationed. Our advice? Place your order now for a good stockpile of components while the hobbyist's paradise still exists.

WAVEFORM GENERATOR, BF-5 Just one of these BF-5 devices produces sine, square, triangle, ramp and sawtooth waveforms without additional active components. By adding a second BF-5, you can create amplitude, frequency or phase modulated varieties of these waveforms. They are able to replace large discrete waveform generators costing from $200.00 to $1300.00. At the same time, they greatly reduce system weight and power consumption. Full technical data, P.C. layout, assembly, and hook-up instructions included.

BF-5 WAVEFORM GENERATOR..... $9.75

GENERAL ELECTRIC PA-234,1.4-WATT POWER AMPLIFIER..... $1.25 This amplifier is housed in a plastic dual in-line package with a tab for heat transfer. Has only four active terminals, and requires only one capacitor for stabilization. Compatible with 8, 16, or 22-ohm loads. Applications include P.A. systems, phonos, movie projectors, TV, AM and FM receivers. **GENERAL ELECTRIC PA-265, 5-WATT VOLTAGE REGULATOR.** Housed in plastic dual in-line package with staggered leads and power tab. Usable over wide range of input and output voltages, input voltages to 37 volts and outputs from 3 to 30 volts. Usable in a wide variety of circuits.

PA-234 POWER AMPLIFIER $1.25
PA-256 VOLTAGE REGULATOR $1.25



SUPER QUALITY I.C. SOCKETS Sockets made by T.I. and Cinch. All are low-profile, compact types.
14 Pin Dip Solder Tale Sockets
3 for $1.25 16 for $5.00
16 Pin Dip Solder Tale Sockets
2 for $1.00 13 for $5.00
14 Pin Dip Gold Wire Wrap Sockets
2 for $1.25 10 for $5.00
16 Pin Dip Gold Wire Wrap Sockets
2 for $1.50 8 for $5.00
10 Pin To-5 Gold Sockets (Cinch)
2 for $1.00 13 for $5.00

SINGLE CHIP 7-SEGMENT DISPLAY COUNTER, AND DECODER. That's right! A single chip TTL decade counter with latches, BCD outputs, a 7-segment decoder driver, AND a 7-segment LED display (with decimal) on top. Only 0.15" thick (not counting pins), the chip mounts in a standard 16-pin DIP socket. Digits are 0.270" high and can be latched in during the next count or blanked.

0.27 DLD $15.00

SPECTRA – STRIP FLAT BONDED We know this is what everyone wants for their home-brew projects, because they always ask for it. We now have over 5 by 10^3 feet, but it won't last long, so order now before it's all gone. We don't want any broken hearts. Specs: 20 conductors, 24 AWG, 7 strands, size is .86" x .044". We could give all its virtues, but most people know them or could easily look it up in any industrial electronics house catalogue.

Sh. Wt. 1 lb./10 feet.....Order No. SSF8RC (ft.)
Price: $.35/1 ft. $1.00/3 ft. $5.00/18 ft.
$30.00/100 ft. $55.00/200 ft. $100.00/400 ft.
$200.00/900 ft. $500.00/2000 ft.

70 WATT RMS AUDIO AMPLIFIER BASIC PACKAGE, STEREO $5.50 Take advantage of Signetic's NE540 power driver, (class AB amp). Designed for 35 watts RMS per channel. Distortion .5% frequency response, ± .5db 20Hz to 100Hz. NE540 requires two power transistors, a 2N5296 (NPN) and a 2N6109 (PNP), supplied per NE 540. Kit package includes (2) NE540, (2) 2N5296, (2) 2N6109, information on P.C. board layout, parts and circuitry, and a list of miscellaneous small parts required to build the 70 watt amplifier for stereo.

☐ NE540 $2.25/ea.
☐ 2N5296 35 watt NPN .75/ea.
☐ 2N6109 40 watt PNP .75/ea.
☐ 70 watt Stereo Kit $5.50/ea.
☐ 35 watt Mono Kit $2.95/ea.

HARD-TO-GET DIGITAL I.C.'s SALE

☐ 7447 BCD To-7 Segment Decoder Driver $1.06
☐ 7490 Decimal Counter..... $ .76
☐ 7485 Comparator..... $1.25
☐ 74192 Up-Down Counter..... $1.45
☐ RCA CD4001 Quad 2-Input Nor Gate (Cosmos)..... $1.25
☐ RCA CD4007 Complementary Pair & Inverter..... $1.50
☐ RCA CD4010 Hex Buffer..... $1.50

MISCELLANEOUS SEMICONDUCTORS, SALE

☐ MUS 4988 Silicon Uni-lateral Switch. Useful for voltage-sensitive switch, sweep generators, etc. $1.00
☐ MUS A65 PNP High-Current Darlington Transistor. Super high gain in a small package. 2/$1
☐ MPS A14, NPN, SAME AS ABOVE 2/$1.00

COMPACT BRIDGE

2 Amp 200 Volt $ .60
2 Amp 400 Volt $1.00
2 Amp 600 Volt $1.50
2 Amp 800 Volt $2.00
2 Amp 1000 Volt $2.50
4 Amp 400 Volt $1.50
4 Amp 600 Volt $2.00
4 Amp 800 Volt $2.50

PLASTIC FIBER OPTICS. Plastic optical monofibers are conveniently card-mounted and available in five different fiber diameters. Excellent supplement for B and F Fiber Optic Kits to provide additional fiber optic material. Fibers available in diameters of .005" (250 ft. card). Offer design versatility to R&D and product engineers. Specifications – maximum cont. oper. temp. - 170 degrees Fahrenheit, acceptance angle - 67 degrees, numerical aperture - 0.55, transmission range - 0.4 to 1.5 microns. YOUR CHOICE – $1.00

TIMER, 0 to 2.75 MINUTES GENERAL TIME. New packaged timers, for 115V, 60 Hz. Timer is set for 2.75 minutes (165 seconds) of operation. At the end of operating cycle, a SPDT switch is closed. May be reworked to provide any time delay between 0 and 2.75 minutes. Makes a useful lab or sequence timer. Latest design with current list price of $15.00

Sh.Wt. 1 lb. TGT $2.75 ea.
2TGT $5.00/2

SGS TAA 621 AUDIO AMPLIFIER

☐ I.C. audio amplifier in 14 pin DIP package, provides up to 4 watts power with proper heat sink, and 28 Volt supply. Can be used at 12 Volts with reduced output power. - $1.95 ..... 6 for $10.00

LOGIC AND OPERATIONAL AMP' SUPPLIES

☐ Figure A, potted logic supply, 5 Volts at 1 Ampere, short circuit proof, ultra high regulation, ultra low ripple $16.00
☐ Figure A, potted Op Amp supply, +15 Volts, and -15 Volts at 0.8 Amperes. Mfg. by Analog Devices, similar to their model 902. Short circuit proof, ultra high performance. $29.00
☐ Figure B, 5 Volt 1Amp supply, regulated by Fairchild 9305, short circuit protected. $9.75
☐ Same as above, in kit form $7.75
☐ Mating connector for above $1.00
☐ 5 Volt 5 Amp regulated supply, by Shulyne, (not shown) $29.00

CALCULATOR CHIP SPECIAL!!! One of the largest manufacturers of MOS Integrated Circuits has discontinued his three-chip set in favor of a single chip. This is the hobbyist's gain, since he can now obtain this fully tested, highly flexible set at a fraction of what even the largest calculator manufacturers pay. Consists of three 24-pin I.C.'s, has debounced input, eight-digit capacity, decoded seven-segment output. Full data included.

8-Digit Floating-Point Calculator Set..... $9.75

FAIRCHILD VOLTAGE REGULATORS This is the UA 7800 Series. Three terminal regulator, with thermal overload protection and internal current limiting, making it essentially blow-out proof. Because simple circuitry is used with this device, designing regulated power supplies is duck soup. Output is rated at 0 to 1 ampere; maximum input voltage is 35 volts. Choice of voltages: 5,6,8,12,15,18, or 24 Volts. Order as 7805, 7806, 7808, etc.

Voltage Regulator (Specify Voltage)..... $2.00

SHRINK TUBING. B and F has a truckload of shrink tubing, but we still expect it to go fast. If you have ever used shrink, you know it is indispensable for electronic construction. Made a wire too short? Just splice and shrink tubing over it and it will look like new. Pins too close? Same solution. Excellent results with hot-air gun, soldering iron, or even a match. This is polyolefin type where outer wall shrinks, inner wall melts to encapsulate wire.

SHRINK TUBING ASSORTMENT, 25 feet each, of 1/8, 3/16, 1/4-inch tubing $5.00

SPECIAL I.C.'S, PHASE LOCKED LOOPS

☐ NE560 Phase Locked Loop $4.65
☐ NE561 Phase Locked Loop $4.65
☐ NE562 Phase Locked Loop $4.65
☐ NE565 Phase Locked Loop $4.65
☐ NE566 Function Generator/Tone Encoder.. $4.65
☐ NE567 PLL/Tone Decoder $4.65
☐ NE595 Four Quadrant Multiplier..... $3.75
☐ NE555 Timer, 2u Sec to 1 hour. Special... $1.25

[] Send $.25 for latest Catalog.

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Phone in charges to (617) 533-5776 or (617) 533-3923.
BankAmericard – Mastercharge. $10.00 minimum. No C.O.D.'s please.

CHARGES WELCOME

$10.00 Minimum Charge

BANKAMERICARD

B. & F. ENTERPRISES
Phone (617) 533 3923
P.O. Box 44, Holliston, Massachusetts 01937

BRAND NEW CATALOG THOUSANDS OF SURPLUS BARGAINS

GIANT 2½" NUMERAL "NIXIE" CLOCK KIT

New! For factories, offices, and commercial establishments, and those people who like large displays, characters appear as a bright continuous line which can be read from distances as great as 150 feet. All drive circuits are solid state, and unit employs new custom LSI clock chip. Indicates hour, minutes, and seconds. May be wired for 24 hour or 12 hour operation with a simple jumper change. Kit offered complete with or without case for custom installations. Parts include P.C. board, sockets, solid state components, hardware, resistors, caps, viewing filter, etc.

Sh.Wt. 15 lbs.

With Case	GNNC/C	$98.50
Without Case	GNNC	$84.50

LOW-PRICED 6-DIGIT CLOCK KIT

New, low-priced digital clock with General Electric 7-segment numeric display tubes, in a styled walnut wood cabinet. In 1972, the B&F nixie display clock made history by being the first and only clock with electronic hours, minutes, and seconds display under $100. Now we have broken the $50 price barrier for 1973, and we doubt that anyone in the near future will be able to match this super-low price! This economy is made possible by a new large-scale integration chip, custom-designed for a six-digit clock. Clock has BCD output for external devices. May be wired for 24 or 12 hour operation with only a simple jumper change. Complete with all parts, sockets, instruction manual, and real wood case. Only a soldering iron and a screwdriver are required.

Sh.Wt. 5 lbs. LPDCW $47.50

SANKEN HIGH POWER, HIGH PERFORMANCE HYBRID VOLTAGE REGULATORS

These hybrid regulators are easy to use, requiring no external components. Excellent for operational amplifier supplies, logic supplies and other high performance applications. All regulators have less than 50 millivolts ripple and better than 1% line and load regulation, some models far exceeding this specification.

- ☐ SI31120E 12 Volts, 1 Ampere $2.25
- ☐ SI31150E 15 Volts, 1 Ampere $2.25
- ☐ SI31240E 24 Volts, 1 Ampere $2.25
- ☐ SI31050E 5 Volts, 1 Ampere $2.25
- ☐ SI3554M 5 Volts, 3 Amperes $7.00

WIRE-WRAP COMPUTER WIRE

New surplus from a large computer company. Solid silver-plated OFHC copper conductor. Special high-temperature, thin-wall insulation of teflon, and other quality materials. Extremely rugged and flexible wire-wrap wire. In addition to usual applications, can be used for effective breadboarding, and wherever quick stripping of solid wire is desired. Different colors are now available. State first, second, and third choice of colors. Shipping weight per 500' is 1 lb.

Conductor Size	Order No.	500'	1000'	10,000'
30	WWW30(ft.)	$5.00	$9.00	$75.00
26	WWW26(ft.)	$6.00	$11.00	$95.00
24	WWW24(ft.)	$6.50	$12.00	$100.00

ROTARY THUMBWHEEL SWITCH

Brand new digital switch, available with output in straight decimal form, or BCD. Widely used to set up predetermined counts or intervals, digital values or digital-to-analog values. Prices quoted are per section, or decade.

DECIMAL OUTPUT (10-position)	RTSDCD	$2.35
BINARY-CODED DECIMAL OUTPUT	RTSBCD	$2.35

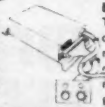
HIGH-TEMP. POWER TRANSISTOR

2N1015D NPN Silicon 200W Power Amplifier 200V 10A $2.00
10 for $17.50 or 100 for $150.00

SANKEN HYBRID AUDIO AMPLIFIER MODULES. We have made a fortunate purchase of Sanken Audio Amplifier Hybrid Modules. With these you can build your own audio amplifiers at less than the price of discrete components. Just add a power supply, and a chassis to act as a heat sink. Brand new units, in original boxes, guaranteed by B and F, Sanken, and the Sanken U.S. distributor. Available in three sizes: 10 watts RMS(20 watts music power), 25 watts RMS (50 watts M.P.), and 50 watts RMS, (100 watts M.P.) per channel. Twenty-page manufacturer's instruction book included. Sanken amplifiers have proved so simple and reliable that they are being used for industrial applications, such as servo amplifiers & wide band laboratory applications.

- ☐ SI1010Y 10 watt RMS amplifier, industrial grade $4.75
- ☐ SI1025A 25 watt RMS amplifier, industrial grade $14.75
- ☐ SI1050A 50 watt RMS amplifier, industrial grade $22.50
- ☐ SI1026E 25 watt RMS amplifier, economy grade $14.00
- ☐ SI1050E 50 watt RMS amplifier, economy grade $21.00
- ☐ Transformer for stereo 10-watt amplifiers (2 lbs.) $3.95
- ☐ Transformer for stereo 25 or 50 watt amplifiers (5 lbs.) $5.95
- ☐ Set of (3) 2000 mfd 50V capacitors for 10-watt stereo $4.00
- ☐ Set of (3) 2200 mfd 75V capacitors for 25 or 50 watt amplifiers $5.00
- ☐ 4 Amp Bridge Rectifier, suitable for all amplifiers $2.00
- ☐ Complete kit for 100 watt RMS stereo amplifier (200 watt music) including two 50-watt Sanken hybrids, all parts, instructions, and nice 1/16" thick, black anodized and punched chassis $88.00
- ☐ Same for 50 watt RMS stereo amplifier, includes two 25 watt Sankens, etc. $68.00
- ☐ Same for 20 watt RMS stereo, includes two 10-watt Sankens, etc. $30.00

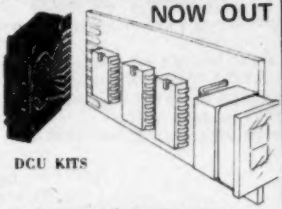
ELECTRONIC PRESET COUNTER



This counter is from a copying machine. It uses two Durant electro-mechanical decade counters, and includes a nice power supply, etc. Two rotary switches allow the unit to be preset with any number from 1 to 50. When the number of pulses in reaches this count, a relay opens, shutting off the controlled unit. Should be useful for coil winders, and other applications requiring shut-off at a predetermined count. The parts alone at our low price represent a "steal", as the unit has high quality switches, silicon rectifiers, transformers, etc.

☐ Preset Electronic Counter (6 lbs.) $8.75

NOW OUT



DCU KITS

DECADE COUNTING UNITS WITH READOUTS

Always one of B & F's most popular items, now revised to include drilled boards, I.C. sockets, and right-angle socket for readout. Arranged so that units can be stacked side by side and straight pieces of wire bussed through for power, ground and reset. Several different units are available as follows:

- 7490 Basic 10 MHz counter. Used in frequency counters and events.
- 74196 Same as 7490 except presettable 50 MHz unit. Used where higher speed and/or presettability is required.
- 74192 Bi-Directional Counter, 32 MHz operation. Has two input lines, one that makes the unit count up, the other down. Uses include timers, where the counter is preset to a number and counts down to zero, monitoring a sequence of events, i.e., keeping track of people in a room by counting up for entries and down for departures.
- 7475 Adds latch capability. Used in counter so displays continue displaying frequency while new frequency is being counted for uninterrupted display.
- 7447 Basic decoder module. Drives basic seven segment display which is included for all modules.

NEWEST DCU!

This DCU combines all of the features of our other counting units, plus it, high speed counting, up/down operation, storage, and preset. In addition it includes a comparator (7485) and a thumbwheel switch in order to provide comparison and preset capability. With this combination you can do the following:

1) Count up or down at speeds to 33 MegaHertz.
2) Store previous count during new count.
3) Preset to any number, count down (or up) and generate a logic level when count of zero is reached. Stack several units and generate logic level for any count greater than zero.
4) Preset to zero, count up (or down) and generate a logic level for any number greater or equal to the number preset on the thumbwheel switch. Stack several DCU's and generate a logic level showing whether number is greater than, equal to, or less than numbers preset on switches.

7490 - 7447 Counter	$8.25
7490 - 7475 - 7447 Counter	$9.25
74196 - 7475 - 7447 Counter	$10.25
74192 - 7447 Counter	$9.25
74192 - 7475 - 7447 - 7485 Universal DCU	$14.50

FUNCTION GENERATOR KIT

IMPOSSIBLE? A $700.00 function generator for $99.00? But true! The new, low-cost EXAR-205 monolithic waveform generator makes this price possible. Our kit uses two generator circuits – one is a carrier generator, and produces sine, triangle, square, sawtooth, ramp and pulse waveforms. The second is a modulation generator, for amplitude or frequency modulation of the output waveforms. Output frequency range is from 20 Hz to 1.5 mega-Hertz. Modulation is switch-selectable for internal AM, internal FM, or external modulation.

Model AR-620K Function Generator $99.00

EPOXY RECTIFIERS

1 Amp	400 Volts	8 FOR $1.00
2.5 Amp	1000 Volts	4 FOR $1.00

☐ **Send $.25 for latest super catalog.**

ALL ITEMS WHERE WEIGHT NOT SPECIFIED
POSTAGE PAID IN THE U. S. A.
Phone in charges to (617) 531-5726 or (617) 532-2323.
Bank Americard – Mastercharge. $10.00 minimum. No C.O.D.'s please.

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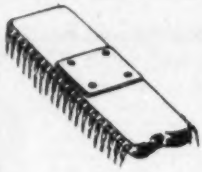
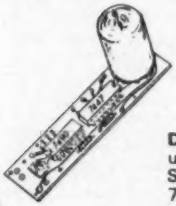
CALCULATOR ON A CHIP
40 pin DIP package –



Add, subtract, multiply, and divide
12 digit display and calculate
Chain calculations
True credit balance sign output
Automatic overflow indication
Fixed decimal point at 0, 2, 3, or 4
Leading zero suppression
Complete data supplied with chip

Only $9.95

CD-3 Universal Counter Module



Can be programmed to count to any modulus 2–9 for one kit, 2–99 for two kits, etc. Includes board, 7490, 7447, RCA DR2010 Numitron display tube and five programming components. Full instructions included – perfect for displaying second, minutes and hours, etc.

Complete $9.25

DIGITAL SPECIAL

Ten brand new (on carriers) dual-in-line JK flip-flops–LU321 with data sheet and two pages of application notes describing hookups for–divide by three through ten, and twelve. Also self correcting ring counter hookups, etc.

10 LU321 W/data $4.00

TTL dual-in-line

7400, 7401, 7402, 7404, 7405, 7410, 7420, 7430, 7440, 7450, 7451, 7453 .. 100 for $18.00	ea.$..20
7441 BCD decoder driver	1.00
7442 BCD decoder	.90
7473 dual JK flip-flop	.55
7474 dual type D FF	.40
7475 quad latch	1.15
7476 dual JK FF	.55
7480 gated full adder	.50
7483 4 bit full adder	1.15
7486 quad exclusive or gate	.65
7489 64 bit RAM	3.00
7490 decade counter	.90
7492 divide by 12 counter	.90
7493 4 bit binary counter	.90
74154 one of 16 decoder	2.50
74192 up/down decade counter	2.25
74193 up/down binary counter	2.00
74195 unv. 4 bit SR	.90
8220 parity gen/checker	1.00
8200 4 bit magnitude comparator	1.60
8280 preset decade counter	1.15
8281 preset binary counter	1.15
8520 25 MC divide by "N" 2 to 15	2.00
7495 4 bit SHIFT REGISTER	1.15
8590 8 bit shift register	2.00
8270 4 bit shift register	2.00

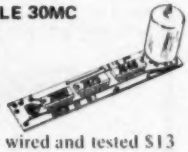
LINEAR SPECIAL

Ten (10) operational amplifiers with a two-page sheet of application notes covering the basic circuits using op-amps ..... $ .55 each
Op-amp package 10-741's, data sheet and application notes; 14 DIP, 8 DIP choice.....only $5.00

LINEAR IC's (dual-in-line)

LM100 positive voltage reg.	.80
747 dual 741 op amp DIP	1.00
LM302 voltage follower op-amp	1.25
709 operational amplifier	.35
710 voltage comparator	.50
LM309K 5V-1A power supply module	2.50
LM 380 2watt audio amplifier	1.50

DIGITAL COUNTER MODULE 30MC



unit includes board, SN7490, SN7475 quad latch, SN7447 7-segment driver and RCA "numitron" display tube W/decimal. 1" x 4.5" module will mount on 1" centers.

kit $10.95 – wired and tested $13

LAST MINUTE ADDITIONS

NE565 Phase lock loop, TO-5	$3.50 ea.
NE566 Function Generator, DIP (8 pin)	$3.50 ea.
NE567 Tone decoder, DIP (8 pin)	$3.50 ea.
7447 7 segment decoder driver	$1.30
74181 Arithmetic Logic Unit, 24 pin, DIP	$4.50
8261 fast carry for above	$2.00
8223 256 bit bipolar field programmable, read-only memory	$7.50
8570 9 bit S1, PO, shift register	$2.50
LED Red Emitting Lamp	$.60

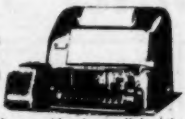
All IC's are new and fully tested – leads are plated with gold or solder. Orders for $5 or more will be shipped prepaid. Add 35¢ handling and postage for smaller orders. California residents add sales tax. IC orders are shipped within two workdays of receipt of order – kits are shipped within ten days of receipt of order. Money back guarantee on all goods sold.

BABYLON ELECTRONICS

SEND FOR FREE FLYER

P.O. Box J
CARMICHAEL, CA 95608
(916) 966-2111

Teletype Model 15 less cover with Synch Motor & Keyboard **$49.50**



Model 19 with Synch Motor Keyboard (with built in Tape Punch) and Trans. Dist. less tables **$85.00**

Typing Reperf Strip Printer type **$24.50**
Non typing **$19.95**

Teletype Paper Carbon Type case of 12 rolls **$3.95**

Reperf. Tape 11/16 case of 40 rolls **$4.95**

88 MH Coils Package of 5 ..... **$1.50**

Collins Variable Crystal Oscillator contains 18 crystals mounted on a turret with a precision geared switching arrangement that selects the proper crystal and coil comb. thus giving a wide selection of freq. Crystals included (omitting fractions) are 26 MC 27, 28, 30, 30.111, 31, 31.1, 31.6, 32, 33, 34, 35, 35.5, 36, 36.6, 37, 38, 38.8 all mounted inside Crystal Oven only **$9.95**

Wall Telephone with dial ready to mount and use **$4.95**

Telephone Dial **$1.95**

Field Telephone Wire 2 conductor 1250 foot reel **$12.95**

Magneto Telephones consisting of a wood case with hand crank magneto and a cradle
Wall Telephone

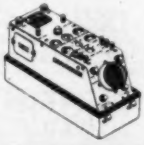
and a cradle phone in like new cond. **$9.95**

Western Union Facsimile Unit Trans. & Rec. with 60 Vy supply, 12 x 12 x 6" used in many offices, complete with conversion sheets for ... **$9.95** Buy Six and get One **FREE**

● Same unit but may need a little work. **$4.95 ea.**

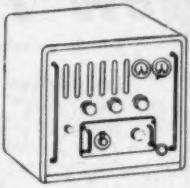
Paper for above, 100 Trans. & 100 Rec. sheets **$1.95** for the 200 sheets

OS-8E/S Oscilloscope. This is the "E" model of this series which is a later version, portable 3" scope. Size 6 x 8 x 14" AC supply, 2 MC wide with carrying case Wt 12 lbs **$39.50**



FR38 Counter same as HP524B, 8 places, Freq. Range 10 KC to 10 MC and can be used to 100 MC to 200 MC and up to 500 MC with proper plug-in (unit can be used to 10 MC without plug-in. Good cond. **$75.00**

10 to 100 MC plug-in **$24.50**



TS1060 Teletype Distortion Test Set. Compact 3" Scope Indicator 110V 60 Cy Power 6 x 8 x 14" **$14.95**

5 Level Punch Tape Reader. Range from 0–250 WPM depending on pulse rate to solenoid **$7.50**

Crystal Kit for PRC6 Walkie Talkie contains 42 crystal in a metal carrying case **$9.95**

TA1 Sound Power Unit Compact hand held. Just hook up wire and use. With built in generator for ringing. No Batteries Needed .... **$12.50 ea.**

GRC & PRC Equip.

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RT67 FM Transceiver 27 to 39 MC **$39.50**
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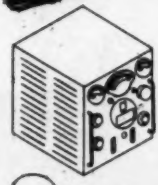
Special PRC9 Back Pack Type Walkie Talkie 27 to 39 MC in Exc. cond. with back pack access. and battery case ideal for general comm., hunting etc. **$49.50**

LR Frequency Standard Range 160 KC to 15 MC ± .003% (to 60 MC extended) with a 100 KC crystal. Wt. about 150 lbs. Unchecked only **$39.50**



APQ41 Radar X Band Transceiver with a 4J50 Magnetron and a 2K25 Klystron with all tubes compact Exc. Cond..... ..... **$39.50**

Command Rec–Trans.

3 to 4 MC **$9.95**
190 to 550 KC **$9.95**
190 to 550 KC later version **$12.50**

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Catalog Number	Any Quantity Per Item (Min) 1- 99	100- 999	1000 up	Multiples of 10 Per Item (Min) 100- 990	1000 9990	10000 up
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7401	.26	.25	.23	.22	.21	.20
7402	.26	.25	.23	.22	.21	.20
7403	.26	.25	.23	.22	.21	.20
7404	.30	.27	.25	.24	.22	.21
7405	.30	.27	.25	.24	.22	.21
7406	.52	.50	.47	.44	.42	.39
7407	.52	.50	.47	.44	.42	.39
7408	.32	.30	.29	.27	.26	.24
7409	.32	.30	.29	.27	.26	.24
7410	.26	.25	.23	.22	.21	.20
7411	.58	.55	.52	.49	.46	.44
7413	.58	.55	.52	.49	.46	.44
7416	.52	.50	.47	.44	.42	.39
7417	.52	.50	.47	.44	.42	.39
7418	.32	.30	.29	.27	.26	.24
7420	.26	.25	.23	.22	.21	.20
7421	.26	.25	.23	.22	.21	.20
7423	.80	.76	.72	.68	.64	.60
7425	.50	.46	.43	.43	.40	.38
7426	.34	.32	.31	.29	.27	.26
7430	.26	.25	.23	.22	.21	.20
7437	.36	.33	.30	.28	.25	.22
7438	.36	.33	.30	.28	.25	.22
7440	.26	.25	.23	.22	.21	.20
7441	1.73	1.64	1.55	1.46	1.37	1.27
7442	1.27	1.21	1.14	1.07	1.01	.94
7443	1.27	1.21	1.14	1.07	1.01	.94
7444	1.27	1.21	1.14	1.07	1.01	.94
7445	1.71	1.62	1.53	1.44	1.35	1.26
7446	1.24	1.17	1.11	1.04	.98	.91
7447	1.16	1.10	1.04	.98	.92	.85
7448	1.44	1.37	1.29	1.22	1.14	1.06
7450	.26	.25	.23	.22	.21	.20
7451	.26	.25	.23	.22	.21	.20
7453	.26	.25	.23	.22	.21	.20
7454	.26	.25	.23	.22	.21	.20
7459	.26	.25	.23	.22	.21	.20
7460	.26	.25	.23	.22	.21	.20
7470	.42	.40	.38	.36	.34	.32
7472	.38	.36	.34	.32	.30	.29
7473	.50	.48	.45	.43	.40	.38
7474	.50	.48	.45	.43	.40	.38
7475	.80	.76	.72	.68	.64	.60
7476	.56	.53	.50	.48	.45	.42
7480	.76	.72	.68	.65	.61	.57
7482	.99	.94	.88	.83	.78	.73
7483	1.63	1.55	1.46	1.38	1.29	1.20
7485	1.43	1.35	1.28	1.20	1.13	1.05
7486	.38	.36	.32	.39	.36	.34
7490	.80	.76	.72	.68	.64	.60
7491	1.43	1.35	1.28	1.20	1.13	1.05
7492	.80	.76	.72	.68	.64	.60
7493	.80	.76	.72	.68	.64	.60
7494	1.18	1.12	1.05	.99	.93	.87
7495	1.18	1.12	1.05	.99	.93	.87
7496	1.18	1.12	1.05	.99	.93	.87
74107	.52	.49	.47	.44	.42	.39
74121	.56	.53	.50	.48	.45	.42
74122	.70	.67	.63	.60	.56	.53
74123	1.21	1.06	1.00	.94	.89	.83
74141	1.63	1.55	1.46	1.38	1.29	1.20
74145	1.41	1.33	1.26	1.18	1.11	1.04
74151	1.20	1.13	1.07	1.01	.95	.88
74153	1.63	1.55	1.46	1.38	1.29	1.20
74154	2.43	2.30	2.16	2.03	1.89	1.76
74155	1.46	1.39	1.31	1.23	1.16	1.08
74156	1.46	1.39	1.31	1.23	1.16	1.08
74176	1.62	1.53	1.45	1.36	1.28	1.19
74177	1.62	1.53	1.45	1.36	1.28	1.19
74180	1.20	1.13	1.07	1.01	.95	.88
74182	1.20	1.13	1.07	1.01	.95	.88
74192	1.98	1.87	1.76	1.65	1.54	1.43
74193	1.98	1.87	1.76	1.65	1.54	1.43
74199	2.81	2.65	2.50	2.34	2.18	2.03

SCHOTTKY TTL

74S00	.88	.84	.79	.75	.70	.66
74S01	.88	.84	.79	.75	.70	.66
74S03	.88	.84	.79	.75	.70	.66
74S04	1.00	.95	.90	.85	.80	.75
74S05	1.06	.95	.90	.85	.80	.75
74S08	.88	.84	.79	.75	.70	.66
74S09	.88	.84	.79	.75	.70	.66
74S10	.88	.84	.79	.75	.70	.66
74S15	.88	.84	.79	.75	.70	.66
74S20	.88	.84	.79	.75	.70	.66
74S22	.88	.84	.79	.75	.70	.66
74S40	1.00	.95	.90	.85	.80	.75
74S50	.88	.84	.79	.75	.70	.66
74S51	.88	.84	.79	.75	.70	.66
74S64	.88	.84	.79	.75	.70	.66
74S74	1.82	1.73	1.63	1.54	1.44	1.34
74S112	1.82	1.73	1.63	1.54	1.44	1.34
74S114	1.82	1.73	1.63	1.54	1.44	1.34
74S140	1.00	.95	.90	.85	.80	.75

LINEAR IC'S

NE501	2.99	2.82	2.66	2.49	2.32	2.16
NE526	3.59	3.38	3.17	2.95	2.74	2.53
NE536	7.31	6.88	6.45	6.02	5.59	5.16
NE537	7.53	7.09	6.65	6.20	5.76	5.32
SE 540	4.48	4.20	3.92	3.64	3.36	3.08
NE560	3.57	3.36	3.15	2.94	2.73	2.52
NE561	3.57	3.36	3.15	2.94	2.73	2.52
NE562	3.57	3.36	3.15	2.94	2.73	2.52
NE564	3.57	3.36	3.15	2.94	2.73	2.52
N5111	.90	.86	.81	.77	.72	.68
N5558	.80	.76	.72	.68	.64	.60
N5565	3.40	3.20	3.00	2.80	2.60	2.40
N5596	1.87	1.77	1.66	1.56	1.46	1.35
709	.42	.40	.38	.36	.34	.32
710	.42	.40	.38	.36	.34	.32
711	.44	.42	.40	.37	.35	.33
723	1.00	.95	.90	.85	.80	.75
733	1.90	1.80	1.70	1.60	1.50	1.40
741	.44	.42	.40	.37	.35	.33
748	.48	.46	.43	.41	.38	.36

TRANSISTORS & DIODES

1N270	.15	.14	.13	.12	.11	.10	1N4003	.13	.12	.11	.10	.09	.08
1N751A	.30	.28	.26	.24	.22	.20	1N4006	.15	.14	.13	.12	.11	.10
1N914	.10	.09	.08	.07	.06	.05	1N4154	.15	.14	.13	.12	.11	.10
1N4001	.10	.09	.08	.07	.06	.05	2N3866	.25	.23	.21	.19	.17	.15
1N4002	.11	.10	.09	.08	.07	.06							

All IC's are supplied in 8-, 14-, 16-, or 24- pin DIP (Dual-in-line) plastic or ceramic package except for NE533, NE536, NE537, and NE540 which come in TO-5 package.

We give FREE data sheets upon request, so ask for those data sheets that you NEED, even for those listed IC's that you are not buying. On orders over $25.00 we'll send you a new 270-page COMPLETE TTL IC data book FREE. Or, you may obtain a new 246-page LINEAR data book instead. Orders over $50.00 will receive both books. Orders over $100.00 will receive a complete LIBRARY of DIGITAL & LINEAR data & application books totaling 1,000 pages FREE. PLEASE NOTE: Data books are shipped separate from your order. Please allow two weeks for delivery.

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1. Easy to read single plane LED or Filament-type Readout with wide angle viewing.
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13. P. C. Boards only are available for $3.00 per decade.

Price (Per Decade):

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For 7475 Latch, add $1.25
For 74176 instead of 7490, add $0.50
For 74192 instead of 7490, add $1.00
For 74196 instead of 7490, add $0.75
For Fully assembled and tested unit, add $2.50

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$0.95 *Each*

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100-999	$0.50
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Large .6" 7-segment LED readout mounts to the popular MAN-1 but with improved brightness. Has left-hand decimal point. Fits in a DIP socket. Expected life: Over 100 Yrs. Regularly $12.95 in single Lots. These are BRAND NEW with full data sheet and 4-page MULTIPLEXING Application Note. Needs a 7447 for driver and ONE CURRENT-LIMITING RESISTOR PER SEGMENT. We can supply you with one or ten thousand FROM STOCK. Also available, 51 OVERFLOW digit at the same prices. Mixing of Regular & Overflow digit allowed.

Package of 8, 74W Limiting R's ..... .30¢

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1.0 µF, 3V ..... .25¢ 2.2 µF, 3V ..... .30¢
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50 µF, 15V ..... .10¢	2 µF, 50V ..... .10¢
100 µF, 15V ..... .10¢	3 µF, 50V ..... .10¢
220 µF, 15V ..... .15¢	5 µF, 50V ..... .10¢
500 µF, 15V ..... .20¢	10 µF, 50V ..... .15¢
1000 µF, 15V ..... .30¢	20 µF, 50V ..... .20¢
20 µF, 25V ..... .15¢	50 µF, 50V ..... .20¢
300 µF, 25V ..... .20¢	100 µF, 50V ..... .30¢
50 µF, 35V ..... .20¢	200 µF, 50V ..... .60¢
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Ideal for use with LM-series. Each $3.00

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930	Dual 4 input NAND gate	similar to	7420
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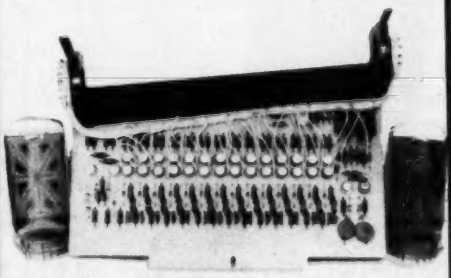
945	JK Flip Flop	"	74110
946	Quad 2 input gate	"	7400
962	Triple 3 input gate	"	7410

15¢ each. Buy $100 worth and deduct 10%. 24 hour delivery guaranteed.

ALPHA-NUMERIC keyboard removed from unused IBM Selectric machines. Bargain price at only $8.00



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Small Size: 2 1/4 X 4 1/2 X 6 3/4

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THE TIME MACHINE utilizes the latest electronic techniques and advances to provide time information like no clock has before. A Large Scale Integration (LSI) circuit provides the logic to convert the 60 hertz line frequency into a displayable time. Internal options include a presettable alarm circuit, five minute snooze, and 24 hour time.

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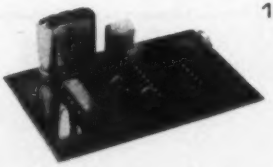

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- NO AC LEAKAGE OR INDUCED CURRENT TO DAMAGE DELICATE ELECTRONIC COMPONENTS.

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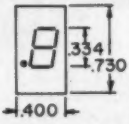

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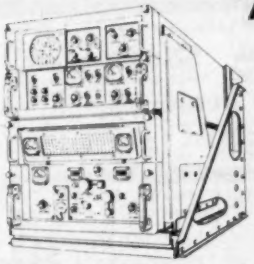

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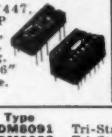

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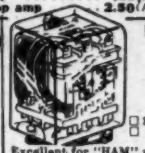

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Fluorescent Blue-Green 0-9 numerals, decimals and letters.

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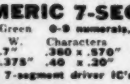

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600	1.35	1.75
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Case: 2 amp TO-5 case
6 Amp ½ x ½ x 3/16 sq

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A = Next higher frequency may be useful also.
B = Difficult circuit this period.

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4

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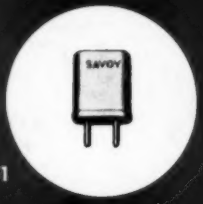

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